2020-12

WHAT WE HAVE HERE IS A FAILURE TO TOURNIQUET: INCREASING THE EFFICACY OF HEMORRHAGE CONTROL TRAINING

Werner, William C.

Monterey, CA; Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

WHAT WE HAVE HERE IS A FAILURE TO TOURNIQUET: INCREASING THE EFFICACY OF HEMORRHAGE CONTROL TRAINING

by

William C. Werner

December 2020

Co-Advisors: Lauren S. Fernandez (contractor)
Carolyn C. Halladay

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** December 2020	**3. REPORT TYPE AND DATES COVERED** Master's thesis

4. TITLE AND SUBTITLE WHAT WE HAVE HERE IS A FAILURE TO TOURNIQUET: INCREASING THE EFFICACY OF HEMORRHAGE CONTROL TRAINING	**5. FUNDING NUMBERS**
6. AUTHOR(S) William C. Werner	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.	**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

Bleeding to death is the primary avertable cause of death for victims who have suffered trauma—like a gunshot wound. Emergency medical services response times of less than five minutes yield the best outcomes for shooting victims, but the average response time is six to eight minutes; help may be even farther away in an ongoing shooting incident or mass shooting event. In emergency incidents, bystanders with some training and some gear—in this case, tourniquets—may provide life-saving aid to victims of traumatic injury until medical personnel can take over. Precedents for involving, equipping, and empowering the public in public safety, including cardiopulmonary resuscitation, automated external defibrillators, and Narcan/Naloxone, have been established. This thesis explores these programs. Several important takeaways from this review can be applied to any immediate responder program. First, priority must be given to providing training in the most widely accessible manner to reach the most people. Second, if specialized equipment is necessary, it must be easy-to-use and readily accessible, and should include instructions. While training is an important first step, building in natural points of contact for trainers and trainees, like requiring recertification, can increase the trainees' retention of and ability to apply those lessons learned.

14. SUBJECT TERMS hemorrhage control, tourniquet, immediate responder, bystander, gunshot wound, bleed	**15. NUMBER OF PAGES** 97
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release. Distribution is unlimited.

WHAT WE HAVE HERE IS A FAILURE TO TOURNIQUET: INCREASING THE EFFICACY OF HEMORRHAGE CONTROL TRAINING

William C. Werner
Intelligence Analyst/Planner, St. Louis Metropolitan Police Department
BS, Missouri State University, 2007
MA, University of Missouri at St. Louis, 2011

Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF ARTS IN SECURITY STUDIES
(HOMELAND SECURITY AND DEFENSE)**

from the

**NAVAL POSTGRADUATE SCHOOL
December 2020**

Approved by: Lauren S. Fernandez
Co-Advisor

Carolyn C. Halladay
Co-Advisor

Erik J. Dahl
Associate Professor, Department of National Security Affairs

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Bleeding to death is the primary avertable cause of death for victims who have suffered trauma—like a gunshot wound. Emergency medical services response times of less than five minutes yield the best outcomes for shooting victims, but the average response time is six to eight minutes; help may be even farther away in an ongoing shooting incident or mass shooting event. In emergency incidents, bystanders with some training and some gear—in this case, tourniquets—may provide life-saving aid to victims of traumatic injury until medical personnel can take over. Precedents for involving, equipping, and empowering the public in public safety, including cardiopulmonary resuscitation, automated external defibrillators, and Narcan/ Naloxone, have been established. This thesis explores these programs. Several important takeaways from this review can be applied to any immediate responder program. First, priority must be given to providing training in the most widely accessible manner to reach the most people. Second, if specialized equipment is necessary, it must be easy-to-use and readily accessible, and should include instructions. While training is an important first step, building in natural points of contact for trainers and trainees, like requiring recertification, can increase the trainees' retention of and ability to apply those lessons learned.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

AED	automated external defibrillators
B-CON	bleeding control
BLS	basic life support
CAO	Circuit Attorney's Office
CAT	combat application tourniquet
CCTV	closed-circuit television
CPR	cardio pulmonary resuscitation
EMS	emergency medical services
GIS	geographic information system
GSW	gunshot wound
JTTS	Joint Theater Trauma System
SLMPD	St. Louis Metropolitan Police Department
STB	Stop the Bleed
SWAT	special weapons and tactics
TCCC	Tactical Combat Casualty Care
TEMS	tactical emergency medical support

THIS PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

This thesis examines how hemorrhage-control training at the community level can improve survival rate for shooting victims. The thesis examined historical tourniquet use and similar immediate responder training programs to develop an understanding of relevant issues and opportunities. The research explores appropriate ways to tailor hemorrhage-control training to the needs of communities suffering from gun violence.

It stands to reason that providing the necessary training—for example Bleeding Control (B-Con) basic training through campaigns like Stop the Bleed—and resources to non-medical laypeople may mean the difference between life and death. Bleeding to death is the primary, avertable cause of death for victims who have suffered trauma such as a gunshot wound.[1] It is possible to provide timely and effective medical attention to victims suffering from gunshot wounds in urban settings before emergency medical services (EMS) arrives.

A thorough review of relevant scholarly and existing literature identifies the origin of hemorrhage-control training and how it has become a recent focus for response to emergency situations. Although public-access hemorrhage-control training is relatively unique, other life-saving interventions and training programs are similar enough to provide valuable insight. For example, a substantial body of research details the costs, benefits, and lessons associated with such other immediate responder programs as those for cardiopulmonary resuscitation, automated external defibrillators, and Narcan/Naloxone. By comparing and contrasting these programs and applying the findings, hemorrhage-control trainings can increase deliverability, retention, and ultimately, the use of training in emergency situations.

This thesis synthesizes lessons learned through a comparative analysis of the aforementioned immediate responder programs and applies them to the specific programmatic needs of St. Louis, Missouri, which is in the early stages of developing and

[1] Matthew J. Levy, "Public Access Bleeding Control: Enhancing Local Resilience," *Prehospital and Disaster Medicine* 31, no. 3 (June 2016): 235, http://dx.doi.org/10.1017/S1049023X16000467.

deploying large-scale hemorrhage control training. The recommendations for St. Louis include the following:

1. Identify vulnerable areas and populations.
2. Identify potential partners.
3. Systematically collect more data specific to homicides and bodily injury location.
4. Distribute trauma kits and tourniquets.

Including broader recommendations for programs beyond those deployed in St. Louis is crucial to increasing generalizability. The general recommendations discussed provide guidance for any jurisdiction, city, county, or state that may be creating a program to teach hemorrhage-control training to its citizens. Overall recommendations include similar points to those provided for St. Louis:

1. Increase access to hemorrhage-control training.
2. Ensure greater access to trauma kits.
3. Increase retention and provide retraining opportunities.

Offering hemorrhage-control training to individuals in communities that have high levels of violence may help to prepare bystanders to provide much-needed emergency assistance. In other words, bystanders with some training and gear may provide life-saving aid to victims of traumatic injury until medical personnel can take over. Hopefully, the recommendations outlined provides the necessary pressure to help local governments and communities consolidate their efforts to support communities dealing with violence.

ACKNOWLEDGMENTS

Primarily, I would like to say that I owe a huge debt of gratitude to my wife and son. They were the ones who truly paid for this thesis. I missed out on so many things during the completion of this thesis. I will forever be in debt to them for it. There is nothing I can do to pay them back, but I will certainly try. Thank you both for all your support and understanding.

I would also like to thank my advisors, Dr. Carolyn Halladay, and Dr. Lauren Fernandez. Their guidance and direction made this document possible. Similarly, I would be remiss if I did not acknowledge the exceptional support efforts of Greta Marlatt, the greatest librarian in history, and Noel Yucuis, the best writing coach a person could ever have. Thank you all.

Finally, a few people helped make this writing process tolerable and helped keep me on track and focused. Thank you to Steven Higgins, Jason Dijoseph, and Angela Coonce.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

Shootings in urban settings are not necessarily increasing in frequency, but they are becoming more lethal.[1] In 2019, in the United States, more than 15,000 deaths and more than 30,000 injuries resulted from firearms.[2] Research suggests that with higher weapon calibers leading to more tissue damage and blood loss, victims are dying before a medical professional can get to them (or vice versa) for treatment.[3] Also, experts agree unequivocally about the role that immediate medical attention plays in surviving a gunshot wound.[4] Bleeding to death is the primary, avertable cause of death for victims who have suffered trauma such as a gunshot wound.[5] Indeed, bleeding to death from a traumatic injury is the main cause of death for Americans between 1–46 years old.[6] Emergency medical services (EMS) response times of less than five minutes yield the best outcomes for shooting victims, but the average response time in cities or metropolitan areas is six to eight minutes, and help may be even further away in an ongoing shooting incident or mass shooting event.[7]

It is possible to deliver timely and effective medical attention to victims suffering from gunshot wounds before EMS arrives. Specifically, offering hemorrhage-control

---

1 Janet L. Lauritsen and Theodore S. Lentz, "National and Local Trends in Serious Violence, Firearm Victimization, and Homicide," *Homicide Studies* 23, no. 3 (August 2019): 243–61, https://doi.org/10.1177/1088767919848665.

2 "Gun Violence Archive 2019 Evidence Based Research-since 2013," Gun Violence Archive, October 10, 2020, https://www.gunviolencearchive.org/past-tolls.

3 Anthony A. Braga and Philip J. Cook, "The Association of Firearm Caliber with Likelihood of Death from Gunshot Injury in Criminal Assaults," *JAMA Network Open* 1, no. 3 (2018): 1, https://doi.org/10.1001/jamanetworkopen.2018.0833.

4 Craig Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," *American Journal of Public Health* 109, no. 2 (February 2019): 236, https://doi.org/10.2105/AJPH.2018.304773.

5 Matthew J. Levy, "Public Access Bleeding Control: Enhancing Local Resilience," Prehospital and Disaster Medicine 31, no. 3 (June 2016): 235, http://dx.doi.org/10.1017/S1049023X16000467.

6 James Alan Chambers et al., "'Stop the Bleed': A U.S. Military Installation's Model for Implementation of a Rapid Hemorrhage Control Program," *Military Medicine* 184, no. 3–4 (2019): 67, https://doi.org/10.1093/milmed/usy185.

7 Thomas H. Blackwell and Jay S. Kaufman, "Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System," *Academic Emergency Medicine* 9, no. 4 (April 2002): 293, https://doi.org/10.1197/aemj.9.4.288.

training to individuals in communities who have high levels of violence may help bystanders provide that much-needed emergency assistance. In other words, bystanders with some training and some gear may provide life-saving aid to victims of traumatic injury until medical personnel can take over—and save lives. Precedents for involving, equipping, and empowering the public in public safety have been established. For example, many buildings are now being outfitted with automatic electronic defibrillator (AED) devices, which are being used to save those suffering from cardiac arrest before a medical professional arrives. Similarly, police, fire, EMS staff, and non-medically trained people are being provided Narcan to save those suffering from an opioid overdose. Thus, it stands to reason that offering the necessary training—for example as B-Con through campaigns like *Stop the Bleed* or *Be the Help*—and resources to non-medical laypeople in communities, may mean the difference between life and death.

A. RESEARCH QUESTIONS

How can hemorrhage-control training at the community level improve the survivability of shootings, and how can hemorrhage-control training be improved by learning from similar training programs?

B. LITERATURE REVIEW

So often, saving a life depends on immediate action. In incidents like a car accident, a pedestrian struck by a vehicle, a heart attack, or a violent encounter, bystanders must choose either to step in and help someone who is injured and potentially dying, or not. One of the best-known instances of bystanders not intervening when they should have was the 1964 case of Kitty Genovese. Kitty Genovese was stabbed to death in New York City while several witnesses stood by, listening to her screams for help, and in some cases, watching the prolonged attack from behind their curtained windows.[8] As one author wrote, "For more than half an hour, 38 respectable, law-abiding citizens in Queens watched a killer

[8] Harold Takooshian et al., "Remembering Catherine 'Kitty' Genovese 40 Years Later: A Public Forum," *Journal of Social Distress and the Homeless* 14, no. 1–2 (January 2005): 66, https://doi.org/10.1179/105307805807066284.

stab a woman in three separate attacks in Kew Gardens."[9] For decades, researchers have tried to understand why no one helped. Arguably, many bystanders may have thought that someone else would call or intervene, a phenomenon known as diffusion of responsibility.[10] More broadly, Kitty Genovese's case is—often literally—the textbook example of what is known as the "bystander effect," which seeks to explain why, in larger groups, people will not act to aid someone else, though with fewer bystanders on hand, each is more likely to intervene.[11]

For the 40 years following Kitty's death, the literature focused predominantly on why bystanders fail to act. (For the purpose of this discussion, a bystander is defined as a person who witnesses an emergency event and can provide assistance, and by doing so, decreases the chance of injury and death.)[12] However, more recently, the research has increasingly focused on ways to induce bystanders to act. The consensus in the research is that social dynamics play a critical role. For example, according to Korte in 1971, bystanders tend to act when they feel that no other help is on the way.[13] Based on more recent work by van Bommel et al. in 2012, it is possible to increase the likelihood of a bystander offering help by creating cues that remove situational anonymity or fading into the background to avoid being involved.[14] Finally, evidence suggests that bystanders are more likely to act if they are empowered by providing the skills necessary to act and understanding that they can positively impact an emergency situation.[15] For example, if

---

9 Takooshian et al., 66.

10 Takooshian et al., 69.

11 Marco van Bommel et al., "Be Aware to Care: Public Self-Awareness Leads to a Reversal of the Bystander Effect," *Journal of Experimental Social Psychology* 48, no. 4 (July 2012): 926, https://doi.org/10.1016/j.jesp.2012.02.011.

12 Mark Faul, Shelley N. Aikman, and Scott M. Sasser, "Bystander Intervention prior to the Arrival of Emergency Medical Services: Comparing Assistance across Types of Medical Emergencies," *Prehospital Emergency Care* 20, no. 3 (2016): 1–15, https://doi.org/10.3109/10903127.2015.1088605.

13 Charles Korte, "Effects of Individual Responsibility and Group Communication on Help-Giving in an Emergency," *Human Relations* 24, no. 2 (1971): 149–59.

14 van Bommel et al., "Be Aware to Care," 926.

15 Sanela Pivač, Primož Gradišek, and Brigita Skela-Savič, "The Impact of Cardiopulmonary Resuscitation (CPR) Training on Schoolchildren and Their CPR Knowledge, Attitudes toward CPR, and Willingness to Help Others and to Perform CPR: Mixed Methods Research Design," *BMC Public Health* 20, no. 915 (2020), https://doi.org/10.1186/s12889-020-09072-y.

people believe they can properly fix a broken widget, they are more likely to try to fix it before relying on someone else to fix it.

Bystander intervention is not simply a question of whether a person will act. People go through many initial phases before deciding to act.[16] The bystanders must first be present for the event, understand it as an emergency, and then finally determine whether it is their responsibility to take action in some way.[17] Importantly, the bystanders have the ability to respond or stand by and do nothing at every point in the aforementioned continuum.[18] The seminal work of Darley and Latané focused on the second step of this process, namely how people evaluate the seriousness of a situation and determine whether it presents an emergency.[19] Their work illustrates the importance of social influence in emergency situations. In essence, they found that individuals often look to others in the situation for cues for how to respond, and tend not to take action because others do not, including the "diffusion of responsibility" at work in the Genovese case.[20] Cues can include looking to others to see if they act and provide help or flee the scene.

Building on the work of Latané and Darley, Schwartz and Clausen illustrated the impact of providing more information specific to others' competency and beneficial skills in an emergency situation.[21] Arguably, when people feel another person is present who can guide them and help them deliver aid appropriately, bystanders should be more willing to act.[22] Among other things, Schwartz and Clausen argued that men are more likely to respond than women, but the authors point out that this observation may be a result of accepted gender roles.[23] It also may be outdated, as the study is from half a century ago.

---

16 Bibb Latané and John M. Darley, "Group Inhibition of Bystander Intervention in Emergencies," *Journal of Personality and Social Psychology* 10, no. 3 (1968): 220, https://doi.org/10.1037/h0026570.

17 Latané and Darley, 220.

18 Latané and Darley, 220.

19 Latané and Darley, 220.

20 Latané and Darley, 221.

21 Shalom H. Schwartz and Geraldine T. Clausen, "Responsibility, Norms, and Helping in an Emergency," *Journal of Personality and Social Psychology* 16, no. 2 (1970): 301, https://doi.org/10.1037/h0029842.

22 Schwartz and Clausen, 301.

23 Schwartz and Clausen, 301.

Either way, the authors found that when another knowledgeable bystander was present, male intervention tended to increase while female intervention decreased.[24] While the specifics associated with the sex of the responder is potentially important, the core factor is that the perception of a knowledgeable, capable person being part of the crowd or group affected how the individuals responded. The work of Schwartz and Clausen illustrates that the crowd or a group of bystanders is anything but useless if proper social cues are available to help entice them to act.

Korte's work suggests that the bystanders' choice to help in an emergency is driven by not only the social situation in which they are operating but also the anticipation of other sources of help.[25] Thus, if a person experiencing an emergency does not expect appropriate help in a timely fashion, bystanders are more likely act. This work helps to explain the scenes often depicted in the media following mass casualty events, in which bystanders are helping injured people and putting their lives at risk to save others. Extrapolating from Korte's work, it is reasonable to suggest that one of the driving factors that led bystanders to act after 9/11, the Boston Marathon bombing, and the Las Vegas Route 91 Festival, was their belief that help was not immediately on the way or available. They had to seize the initiative and respond.

The work of Faul, Aikman, and Sasser focuses on the situational factors that lead to action in an emergency situation.[26] Specifically, they reviewed 16 million emergency calls for service and attempted to identify causes and correlates for bystander action.[27] Faul, Aikman, and Sasser report a bystander intervention rate of about 11 percent.[28] They also assert that the type of emergency plays an integral role in determining whether a person will intervene.[29] For example, the authors show that the circumstances most likely to produce action from a bystander are traumatic injuries, cardiac arrest, allergic reactions,

---

24 Schwartz and Clausen, 301.

25 Korte, "Effects of Individual Responsibility and Group Communication," 159.

26 Faul, Aikman, and Sasser, "Bystander Intervention," 2.

27 Faul, Aikman, and Sasser, 1.

28 Faul, Aikman, and Sasser, 4.

29 Faul, Aikman, and Sasser, 1.

and breathing distress.[30] The authors point to the potential importance of bystander intervention because bystanders, in most cases, far outnumber the professionals who respond to the emergency.[31] Faul, Aikman, and Sasser provide evidence that illustrates how critical overcoming the bystander effect can be.

Over the last two decades, several mass casualty events and emergency situations have illustrated the importance of bystanders and their willingness to help. For example, the Boston Marathon bombing in 2013 illustrated a high rate of survival for the injured due to the immediate response of bystanders.[32] Furthermore, after the 2010 earthquake in Haiti, a majority suffering from injury reported that someone other than a professional had helped them.[33] The work of Faul, Aikman, and Sasser highlight that the bystander can be an important participant in emergency situations.

Recent work by van Bommel et al. suggests that the bystander effect can be mitigated by simply providing cues in public and social settings to encourage bystanders to act.[34] One possible example may be signage stating that the area is under closed-circuit television (CCTV) surveillance, which suggests that someone is or may be watching. According to van Bommel et al., removing the belief that bystanders are anonymous—that their actions are not attributable to them—tends to increase their likelihood of intervention.[35] This finding partially supports the work of Darley and Latané, who posited the size and type of group are the driving factors for bystander intervention in an emergency.[36] The scholarship now broadly agrees that the bystanders look first to each other and then to other "witnesses" (even CCTV cameras) before they do or do not take action.

---

30 Faul, Aikman, and Sasser, 4.

31 Faul, Aikman, and Sasser, 2.

32 Faul, Aikman, and Sasser, 2.

33 Faul, Aikman, and Sasser, 2.

34 van Bommel et al., "Be Aware to Care, 929.

35 van Bommel et al., 927.

36 van Bommel et al., 926; John M. Darley and Bibb Latané, "Bystander Intervention in Emergencies: Diffusion of Responsibility," *Journal of Personality and Social Psychology* 8, no. 4, pt. 1 (1968): 377–83, https://doi.org/10.1037/h0025589.

In 2019, Philpot et al. attempted to show that bystander apathy and nonintervention are actually rare.[37] Philpot et al. support the work of van Bommel et al. by showing that bystander intervention increases when situational anonymity is removed.[38] For their study, Philpot et al. found bystander intervention rates as high as 90 percent for the sample of CCTV clips they reviewed of emergency incidents, in which a person is the victim of a physical attack.[39] However, the evidence they provided was based solely on CCTV footage from 219 incidents in busy commercial areas in the United Kingdom, the Netherlands, and South Africa.[40] Philpot et al. provide evidence that the rate of bystander intervention is quite high, but if the work of van Bommel et al. is correct, then CCTV cameras may likely remove any feelings of anonymity and result in higher rates of action by bystanders.

In sum, research has indicated several factors that influence the likelihood of a bystander getting involved during an emergency. Scholars agree that social dynamics play a critical role. Similarly, when bystanders feel that no other help is likely on the way, they tend to act. It is possible to increase the likelihood of a bystander offering help by creating cues that remove situational anonymity. In addition, bystanders are more likely to act if they are empowered by having the skills necessary to act and understanding that they can positively impact an emergency situation.

C. RESEARCH DESIGN

It could be possible to provide the skills necessary for a bystander to save a life in the case of a traumatic injury, like a gunshot wound, causing major bleeding. The trick is turning a bystander into an "immediate responder," as the specialist literature deems them. For the purposes of this thesis, an immediate responder is defined as an individual at the scene of an incident who acts to provide the necessary aid to an individual suffering from

37 Richard Philpot et al., "Would I Be Helped? Cross-National CCTV Footage Shows That Intervention Is the Norm in Public Conflicts," *American Psychologist* 75, no. 1 (2019): 8, https://doi.org/10.1037/amp0000469.

38 van Bommel et al., "Be Aware to Care," 926.

39 Philpot et al., "Would I Be Helped?," 6.

40 Philpot et al., 1.

an injury or in need of life-saving aid.[41] Several immediate responder programs do teach life-saving skills to laypersons. Hemorrhage-control training like Stop the Bleed (STB) is an example. In general, public access hemorrhage-control training programs like STB follow a similar curriculum. In most cases, the curriculum is Bleeding Control Basic for the Injured, a mechanism by which the techniques championed in the STB campaign are taught to everyday people with no prior medical training.[42]

Hemorrhage-control trainings are designed to be delivered in schools and universities, to staff in transportation hubs, and within communities across the country. The trainings are generally taught by medical professionals, including trauma surgeons, nurses, and emergency medical technicians.[43] Participants listen to presentations and watch videos that provide an overview of the skills they will learn in the hands-on portion of their training.[44] After watching the presentation and videos, the participants practice the application of a combat application tourniquet to a model injured extremity, while being guided by the medical professionals teaching the course.[45] To complete the training, participants must successfully apply a tourniquet and stop the bleeding.[46]

This thesis helps develop a better understanding of the current issues facing the proliferation of hemorrhage-control training, learned from similar immediate responder training, and learned how better to tailor hemorrhage-control training to the needs of communities suffering from gun violence.

---

41 Isaac Ashkenazi and Richard C. Hunt, "You're It—You've Got to Save Someone: Immediate Responders, Not Bystanders," *Frontiers in Public Health* 7 (December 5, 2019), https://doi.org/10.3389/fpubh.2019.00361.

42 "Bleeding Control Basic (BCon) Course v. 1.0: Instructor Information," American College of Surgeons, 2017, https://www.stopthebleed.org/-/media/stop-the-bleed/instructor-files/bleeding-control-basic-instructor-guide.ashx.

43 Roy Lei et al., "Stop the Bleed Training Empowers Learners to Act to Prevent Unnecessary Hemorrhagic Death," *American Journal of Surgery* 217, no. 2 (February 2019): 369, http://dx.doi.org/10.1016/j.amjsurg.2018.09.025.

44 Amelia M. Pasley et al., "Stop the Bleed: Does the Training Work One Month Out?," *American Surgeon* 84, no. 10 (October 2018): 1635–36.

45 Pasley et al., 1635–36.

46 Pasley et al., 1636.

Conducting a thorough review of the existing relevant scholarly and existing literature, I developed a better understanding of the origin of hemorrhage-control training and how it has become a recent focus for response to emergency situations. A substantial body of research is available on the costs, benefits, and lessons associated with such other immediate responder programs as cardiopulmonary resuscitation (CPR), AEDs, and Narcan/Naloxone. I focused on the challenges faced in implementing those programs and the lessons that have been learned throughout the life of the programs. The existing research regarding modern hemorrhage-control training—for example, Bleeding Control Basic for the Injured—and its effectiveness is limited.

Based on information gleaned from the literature review, I conducted a comparative analysis of other immediate responder programs including CPR, AEDs, and Narcan/ Naloxone. Comparative analysis is typically used to explore the similarities and differences between two or more topics or cases of interest.[47] In this case, I compared and contrasted the facets of each program and synthesized the knowledge bases in existing programs and the effects they have on their intended problem spaces.

The St. Louis Metropolitan Police Department (SLMPD), in partnership with local trauma surgeons, is developing hemorrhage-control training specifically focused on victims of violent crime and their families. To identify victims from the most violent areas, I used geospatial information system (GIS) analysis to identify "hot spots" and areas that might benefit the most from the hemorrhage-control training.

Lastly, I identified general areas for improvement, including data collection and equipment distribution. I include broad guidance and recommendations for any group of stakeholders that may be creating programming to teach hemorrhage-control techniques to its citizens.

---

47 Chris Pickvance, "The Four Varieties of Comparative Analysis: The Case of Environmental Regulation," in C*onference on Small and Large-N Comparative Solutions* (Brighton: University of Sussex, 2005), 2, http://eprints.ncrm.ac.uk/57/1/chrispickvance.pdf.

D. CHAPTER OVERVIEW

Chapter II provides a survey of the historical use of hemorrhage-control techniques and the application of lessons learned on the battlefield to civilian application. Not surprisingly, many of these techniques were developed and refined during war. It continues by highlighting the adoption of hemorrhage-control techniques by civilian populations. Historical context for the proliferation and acceptable use of the tourniquet is examined. Furthermore, the chapter describes modern hemorrhage-control training and the STB program. Finally, it provides several examples of how modern hemorrhage-control training has been used by trained immediate responders during emergencies.

Chapter III presents a comparative analysis of existing immediate responder programs. It provides insight into the ways cardiopulmonary resuscitation, automated external defibrillators, and Narcan/Naloxone programs deploy training, certify and recertify skills, and provide the necessary equipment to use the skills learned effectively.

Chapter IV synthesizes the lessons learned from the comparative analysis of similar immediate responder programs and applies them to the specific programmatic needs in St. Louis, which is in the early stages of developing and deploying large-scale hemorrhage control training.

Finally, Chapter V includes broader recommendations for programs beyond those deployed in St. Louis and provides general guidance and recommendations for any jurisdiction, city, county, or state that may be creating programming to teach hemorrhage-control training to people in their communities.

II. ORIGINS OF HEMORRHAGE-CONTROL TECHNIQUES

Hemorrhage-control techniques include the use of tourniquets, pressure application, and wound packing; all currently being used in the United States by medical professionals and bystanders alike to treat traumatic injuries that result in serious bleeding. The primary goal of these techniques is to stop bleeding that has resulted from an injury that may result in death, for instance, a car accident or a gunshot wound.[48] Not surprisingly, many of these techniques were developed and refined on the battlefield. While bleeding control has many facets—pressure application and tourniquet use, for example—the lessons learned in combat ultimately produced a set of easy-to-use and easy-to-teach techniques to allow almost any layperson to control bleeding by using a tourniquet for a traumatic wound.

Mobilization and response—on the battlefield or in the neighborhood—can exceed the time it takes for a person to die as a result of blood loss.[49] Exsanguination, or bleeding out from traumatic injury, is a prevalent cause of death in the United States, and a clear nexus exists between the knowledge gained on the battlefield and treating individuals suffering traumatic injuries at home. Hemorrhage-control teachings based on the Tactical Combat Casualty Care (TCCC)—mass tourniquet distribution and use developed during military conflicts to increase the survivability of battlefield injuries—translate well to the civilian world.[50] Trauma care has advanced significantly as a result of military personnel's experiences, including processes for evacuating victims, handling pain, and managing injury and sickness in the field.[51] Through consistent, rigorous evaluation of outcomes related to the thousands of lives lost and tens of thousands of traumatic injuries on the

---

48 Eric Goralnick et al., "Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS)," *JAMA Surgery* 153, no. 9 (September 2018): 791–99, https://doi.org/10.1001/jamasurg.2018.1099.

49 Robert L. Kierstead, "Recommendation for a National Standard for Tactical Emergency Casualty Care and Israeli Hospital Trauma Protocols in the United States" (master's thesis, Naval Postgraduate School, 2015), 45, http://hdl.handle.net/10945/45883.

50 Chambers et al., "'Stop the Bleed,'" 67.

51 Jonathan Woodson, "The Military Experience and Integration with the Civilian Sector," *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 22.

battlefield in Iraq and Afghanistan, military professionals have learned what works and what does not in a setting where resources are limited and medical help is often far way.[52]

In other words, at the heart of hemorrhage control today is the tourniquet. Tourniquets have not always been viewed as a good treatment for serious bleeds because experts and other observers often fear that overzealous tourniquet use (or sometimes any tourniquet use) will result in permanent nerve damage or the loss of a limb. As more people begin to learn how to use tourniquets properly, however, their value becomes more apparent, and, arguably, more urgent. This chapter outlines the historical context for tourniquet development, use and deployment, and the changing popular opinion of the tourniquet.

A. ORIGINS OF MODERN HEMORRHAGE-CONTROL TECHNIQUES

Tourniquets are simple tools used to cut off the flow of blood from one part of the body to another. For example, if individuals were to cut their forearms, simply using a tourniquet, or a tightly wrapped piece of fabric, between the bicep and the elbow could stop the blood flowing to everything below the tourniquet. On the one hand, this definition is very simple; on the other hand, the modern tourniquet has taken many years to adapt and become a tool that any layperson with minimal training can deploy successfully to save a life. Indeed, the relatively recent renaissance of the tourniquet as an accepted tool, particularly in community-level hemorrhage-control training today, is the result of centuries of trials and tribulations. Thus, while the tourniquet is more than its contentious past, the centuries of controversy—and experience—resonate in contemporary techniques. The use of hemorrhage-control methods like tourniquets dates back to the late 1600s.[53] What began with simply tightly tying cloth bands around extremities eventually evolved into the combat application tourniquets used by the military and first responders today.[54]

---

52 Woodson, 22.

53 David R. Welling et al., "A Brief History of the Tourniquet," *Journal of Vascular Surgery* 55, no. 1 (January 2012): 286, https://doi.org/10.1016/j.jvs.2011.10.085.

54 Welling et al., 286.

Driven by the initial reflection of William Harvey in 1615 that blood flowed through a closed system in the body, the prevailing understanding that blood loss was not as critical a concern began to change, and doctors began emphasizing the need to keep the blood in that closed system.[55] Prior to Harvey, blood loss was considered something less critical than simple inflammation.[56] The earliest accounts of the tourniquet can be traced back to the battle of Flanders in 1674.[57] At this time, tight bands of cloth were used to restrict blood flow during operations in which limbs were amputated.[58] Doctors and early users created new ways to modify and increase the efficacy of the early tourniquet by adding screw or clamp mechanisms or sticks to increase tension on the fabric.[59] Figure 1 illustrates an early screw-type tourniquet.

The screw-type tourniquet was developed in 1718 by Jean-Louis Petit and was heralded as a quick and easy-to-use tool to stop blood circulation in an extremity.[60] The device worked by placing the extremity through the fabric and the screw was tightened to add tension to the fabric and constricting the device, thereby cutting off blood flow. Petit's tourniquet was reportedly used well into the late 1800s and was involved in more than 29,000 amputations during the American Civil War.[61]

---

55 Alan James Hawk, "How Hemorrhage Control Became Common Sense," *Journal of Trauma and Acute Care Surgery* 85 (July 2018): S14, https://doi.org/10.1097/TA.0000000000001862.

56 Hawk, S13.

57 Welling et al., "A Brief History of the Tourniquet," 286.

58 Welling et al., 286.

59 Welling et al., 286.

60 Hawk, "How Hemorrhage Control Became Common Sense," S14.

61 Hawk, S14.

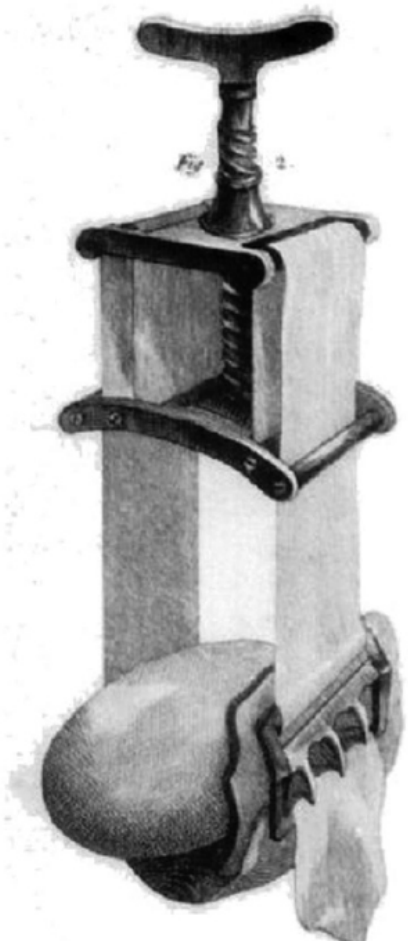

Figure 1. Illustration of a Tourniquet with a Screw Device Used to Increase Tension and Compression.[62]

While more complicated tourniquets were available for use in hospital settings, makeshift tourniquets consisting of little more than a bandana and a stick were used on the battlefield and during the Civil War.[63] However, it should be noted that while many American soldiers of the time carried the pieces needed to make a tourniquet, training was insufficient, which resulted in little use or improper use of the life-saving tool.[64] The poor

62 Source: Welling et al., 287.

63 Welling et al., "A Brief History of the Tourniquet," 286.

64 Welling et al., 289.

training and lack of competent users resulted in nerve damage and the loss of limbs during this era, which only increased the infamy of the tourniquet.[65]

The use of a properly manufactured tourniquet in the operating room to stop bleeding to extremities was a critical part of surgery. Unfortunately, complications arose at times due to the prolonged duration for which the tourniquet was applied.[66] However, thanks to a series of careful experiments in the early 1900s, doctors established proper durations for tourniquet application.[67] Thanks to their diligent efforts, they clearly defined an ideal use of no more than two hours; but, in rare, extreme cases, three to four hours produced no significant injury.[68] Again, the importance of the controlled environment of the operating room cannot be stressed enough. Doctors could properly apply and regulate pressure of tourniquets and minimize the possible negative effects often associated with tourniquet use.[69]

Still, tourniquets notoriously resulted in nerve damage or death of a limb. Thus, many medical authorities during the 19th and early 20th centuries warned against tourniquets in all but the direst cases, for example, when a person had a severe bleed that would result in death if not stopped.[70] That is, it was expected that a tourniquet could save the patient's life, though possibly—if not probably—at the cost of the affected limb.[71] A clear, albeit oversimplified, dichotomy exists, that of life or limb. This situation was particularly acute and devastatingly common when tourniquets were used in a first-aid setting versus in surgery, for example, or in any other situation with well-trained medical personnel present to monitor the tourniquet carefully.[72]

---

65 Welling et al., 286.

66 Welling et al., 289.

67 Welling et al., 289.

68 Welling et al., 289.

69 Welling et al., 289.

70 Hawk, "How Hemorrhage Control Became Common Sense," S14.

71 Welling et al., "A Brief History of the Tourniquet," 287.

72 Welling et al., 287; Hawk, "How Hemorrhage Control Became Common Sense," S13.

Even on the battlefield, soldiers were expected to tell doctors or remember the amount of time a makeshift tourniquet had been applied.[73] Of course, it is reasonable to expect that in the chaos of war, injured soldiers may forget the time or lose consciousness after blood loss. References can be found of cases of gangrene linked to makeshift tourniquets being left on too long or applied too tightly on the battlefield during the Civil War.[74] To clarify, though, it was not solely the tourniquet that ultimately caused nerve damage and limb death but the improper use of this life-saving tool.

The U.S. military often downplayed the use of tourniquets in light of the life-or-limb assumption.[75] In the early to mid-1990s, as the military began to look more closely at the data collected across several conflicts, it was clear that tourniquets, contrary to popular belief at the time, saved more lives than they risked.[76] In particular, when military researchers looked at the time-restricted use of tourniquets in hospital surgical settings, they saw few if any examples of limbs being irreparably damaged by their use.[77] In light of this experience, however anecdotal, the Naval Special Warfare Command and the Uniformed Services University of the Health Sciences set out to complete an exhaustive re-evaluation of battlefield trauma care.[78] The magic, effectively the same as in decades past, was twofold, attention to time and application of pressure.

Their findings resulted in the initial draft of what would become the TCCC.[79] In 1996, the TCCC curriculum established that the use of tourniquets could prevent death by reducing the likelihood of exsanguination.[80] The equipment needed—a combat application

---

73 Welling et al., 287.

74 Hawk, "How Hemorrhage Control Became Common Sense," S14.

75 Andrew D. Fisher, Eileen M. Bulger, and Mark L. Gestring, "Stop the Bleeding: Educating the Public," *Journal of the American Medical Association* 320, no. 6 (2018): 589, https://doi.org/10.1001/jama.2018.7301.

76 Fisher, Bulger, and Gestring, 589.

77 Frank K. Butler, "Two Decades of Saving Lives on the Battlefield: Tactical Combat Casualty Care Turns 20," *Military Medicine* 182, no. 3 (March 2017): e1564, https://doi.org/10.7205/MILMED-D-16-00214.

78 Butler, e1564.

79 Butler, e1564.

80 Fisher, Bulger, and Gestring, "Stop the Bleeding," 589.

tourniquet (CAT), at a minimum—to implement TCCC is simple, easy to operate, and easy to carry.[81] The TCCC curriculum attempted to highlight the likeliest incidents that could result in preventable battlefield deaths and focused on hemorrhage control with the use of tourniquets and pressure.[82] Focusing primarily on extremity bleeds, including the severing of major arteries due to trauma, the TCCC provides guidelines on the use and application of tourniquets to control bleeding and prevent death. Importantly, prior to 2001, the only units that actively practiced and used the TCCC were the U.S. Navy Seals, the 75th Ranger Regiment, the U.S. Army Special Missions Unit, the Air Force Special Operations community, and a subset of other standard and specialized units.[83]

Even though the TCCC was being taught, the consistent use of tourniquets in a combat setting did not become a common practice until after the conflicts in Iraq and Afghanistan in the early 2000s.[84] Soldiers were provided a single field dressing, very similar to what had been provided during World War I, and were taught how to create a compression dressing.[85] Using what was described as a real-time process improvement program, titled the Joint Theater Trauma System (JTTS), during the conflicts in 2004 and 2005 in Iraq and Afghanistan, military personnel used data collected in those conflicts to illustrate a need for a better approach to control bleeding from extremity wounds while in the field.[86] After collecting timely data, specifically, the results of a 10-year evaluation of 4,596 battlefield deaths, researchers found a decrease in deaths resulting from severe extremity bleeds.[87] The decrease illustrated the benefits of tourniquet use, and the JTTS immediately began creating and distributing clinical practice guidelines that outlined the

---

81 Kierstead, "Recommendation for a National Standard," 36.

82 Fisher, Bulger, and Gestring, "Stop the Bleeding," 589.

83 Frank K. Butler, "Military History of Increasing Survival: The U.S. Military Experience with Tourniquets and Hemostatic Dressings in the Afghanistan and Iraq Conflicts," *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 60–61.

84 Fisher, Bulger, and Gestring, "Stop the Bleeding," 589.

85 Hawk, "How Hemorrhage Control Became Common Sense," S15.

86 Welling et al., "A Brief History of the Tourniquet," 288.

87 John B. Holcomb, Frank K. Butler, and Peter Rhee, "Hemorrhage Control Devices: Tourniquets and Hemostatic Dressings," *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 66.

process for training and distributing tourniquets to actively deployed military personnel. As a result of the TCCC and the wide distribution of tourniquets, a substantial decrease, 7.8 percent to 2.6 percent, resulted in combat deaths from extremity bleeds from 2006 to 2011. Specifically, they distributed the modern CAT, which is a small, easy to carry tourniquet that can easily be applied to people themselves, or another person. Modern CATs are essentially a fabric cuff with a stick or rod attached that allows the user to twist and tighten the cuff and apply pressure to stop the flow of blood. The CAT had an impact on how the military responded to traumatic injury within a very short period, and now, every soldier must be provided a tourniquet, be trained on its use, and know how to apply it properly.[88]

B. FIRST RESPONDERS' HEMORRHAGE-CONTROL TECHNIQUES

Many parallels can be seen between the military experiences with tourniquets (and tourniquet-and-pressure techniques) and the processes employed by first responders. Recent estimates suggest that nearly 19 percent of all first responders have military experience.[89] Arguably one of the most significant adaptations of military practice to first responders has been the use of the TCCC and CATs. Adopting the military's response to traumatic injury in a dangerous battlefield setting has led to many first responders' being provided a tourniquet and trained on its use and proper application.

One of the driving forces for this change was the active-shooter incident. The response paradigm to active-shooter situations changed significantly after the shooting at Columbine High School in 1999.[90] Before this incident, special weapons and tactics (SWAT) teams typically staged and waited to make entry into a building until it was deemed safe, which resulted in the loss of precious minutes.[91] Victims of the shooting

88 Welling et al., "A Brief History of the Tourniquet," 289.

89 Simone Weichselbaum, Beth Schwartzapfel, and Tom Meagher, "When Warriors Put on the Badge," Marshall Project, March 30, 2017, https://www.themarshallproject.org/2017/03/30/when-warriors-put-on-the-badge.

90 E. Reed Smith and John B. Delaney, "Supporting Paradigm Change in EMS' Operational Medical Response to Active Shooter Events," *Journal of Emergency Medical Services* 38, no. 12 (December 2013): 48.

91 Smith and Delaney, 48.

remained in the building for hours as first responders coordinated the emergency response. As with soldiers on the battlefield, for a person suffering from a gunshot wound or a severe injury resulting in heavy bleeding, the difference between life and death lies mainly in a swift response. Thus, first responders must deliver needed medical attention to the injured in the quickest, safest way possible. Since it is not always feasible to move a person during an active shooter event to safety, police, fire, and EMS personnel can use tools like a CAT to stop bleeding immediately and prevent exsanguination and to also stabilize the wounded while the building or area is rendered safe.

The first major step in adapting the military process for handling severely injured individuals came in the 1990s, when police and fire departments started deploying tactical emergency medical support (TEMS) teams.[92] These teams support law enforcement special operations or tactical teams by providing medical services under fire, manage injuries including severe bleeds, and rescue and removal of the injured.[93] Wearing body armor and carrying medical supplies like tourniquets and trauma kits, TEMS teams deploy into scenes still considered unsafe, and they are responsible for managing trauma and severe injuries in tactical and sensitive environments.[94] For example, TEMS teams can provide medical attention while an active shooter may still be active in a building, which reduces the time it takes to get needed medical attention. One example in which TEMS teams played a critical role in saving lives was the mass casualty incident in Pima County, Arizona, on January 8, 2011, when Congresswoman Gabrielle Giffords was shot.[95] In this incident, trained deputies provided life-saving care to 19 injured shooting victims who were in danger of bleeding to death while the scene was still considered active and inaccessible to traditional EMS.[96]

---

92 Lenworth M. Jacobs et al., "Initial Management of Mass-casualty Incidents due to Firearms: Improving Survival," *Bulletin American College of Surgeons* 98, no. 6 (June 2013): 30.

93 Jacobs et al., 30.

94 Matthew Watson, "Equipping the Tactical Medic," *Tactical Response*, June 2006, 72–73; Jacobs et al., 30.

95 Tammy Kastre, "Tactical EMS Saved Lives after Giffords Shooting," *Journal of Emergency Medical Services* 37, no. 5 (2012), https://www.jems.com/2012/05/02/tactical-ems-saved-lives-after-giffords/.

96 Kastre.

Unfortunately, TEMS teams are not widely available throughout the United States, limiting general access to their important skillset and a heavy reliance on traditional EMS. Their scarcity is likely due to the cost of training, equipment, and staffing.[97] Perhaps the best use or most value for a TEMS team currently is its support for law enforcement officers should they be shot or injured while clearing a scene, as opposed to evaluating and treating injured non–law enforcement individuals.[98]

C. FROM THE BATTLEFIELD TO MAIN STREET

Based on the lessons in bleeding control developed for the TCCC, pressure application and wound packing are taught throughout the United States with a primary emphasis on tourniquet application for extremity wounds that result in severe bleeding.[99] Through partnerships with military personnel, civilian organizations are beginning to emphasize life-saving practices employed on the battlefield.[100] Accidents, crime, and other random causes of injury happen every day, so if more people possessed the skills and tools necessary to stop a severe bleed immediately—without waiting for EMS—it is reasonable to assume lives may be saved where they may otherwise be lost.

While the TCCC was created primarily as a solution for combat injuries, the American College of Surgeons reworked the curriculum into what is broadly referred to as the Stop the Bleed program to serve civilian needs.[101] Four main organizations are credited with creating the STB effort and creating the B-Con curriculum: the Hartford Consensus Group, the American College of Surgeon's Committee on Trauma, the Committee on Tactical Combat Casualty Care, and the National Association of Emergency Medical Technicians.[102] The STB, sponsored by the Department of Defense, was designed to

97 Kierstead, "Recommendation for a National Standard," 44.

98 Kierstead, 45.

99 Chambers et al., "'Stop the Bleed,'" 68; Frank K. Butler and Richard Carmona, "Tactical Combat Casualty Care: From the Battlefields of Afghanistan and Iraq to the Streets of America," *Tactical Edge*, Winter 2012, 88.

100 Woodson, "The Military Experience and Integration with the Civilian Sector," 23.

101 Chambers et al., "'Stop the Bleed,'" 68.

102 PrepMedic, "Stop the Bleed (Full Course)," May 26, 2019, YouTube, video, 17:46, https://www.youtube.com/watch?v=WGLLXy3AsBQ.

increase awareness and prepare individuals to handle situations with severely injured individuals suffering from major bleeding.[103]

The first bystander STB forum was held in October 2016 and focused on efforts to develop easy bleeding control techniques applicable to non-medically trained individuals and to emphasize the use of tourniquets.[104] Bleeding Control Basic for the Injured curriculum is the mechanism by which the techniques championed in the STB campaign are taught to everyday people with no prior medical training. Interestingly, the concepts and skills delivered through the STB campaign are akin to the approaches endorsed by the Boy Scouts of America in the early 1900s, and recommended by Civil Defense legislation in the 1950s.

1. Precursors to Stop the Bleed

The Boy Scouts of America in the early 1900s discuss bleeding-control techniques in terms that resonate with contemporary conceptions.[105] In the first edition of the *Boy Scout Handbook*, published in 1911, tourniquet use is described as a way to control severe bleeding.[106] Indeed, the ability to apply a tourniquet properly, according to the 1911 handbook, was a criterion for becoming a second-class scout, or tenderfoot.[107] To this end, the 1911 handbook briefly but appropriately describes what to do in the case of an injury that results in a severe bleed. The first step is to identify the severity of the bleed and how to apply pressure properly to stop it.[108] Second, the scout is instructed to fashion a tourniquet out of a handkerchief, stone, and a stick of roughly a foot long.[109] The scout should apply the tourniquet, and once the bleeding has stopped, the scout is instructed to

---

103 PrepMedic.

104 Chambers et al., "'Stop the Bleed,'" 67.

105 Boy Scouts of America, *Boy Scout Handbook*, 1st ed. (Irving, TX: Boy Scouts of America, 1911), https://www.gutenberg.org/files/29558/29558-h/29558-h.htm; Office of Civil Defense, *In Time of Emergency: A Citizen's Handbook on Nuclear Attack and Natural Disasters* (Washington, DC: Department of Defense, 1968), 62, https://www.governmentattic.org/21docs/InTimeOfEmergency_1968.pdf.

106 Boy Scouts of America, *Boy Scout Handbook.*

107 Boy Scouts of America.

108 Boy Scouts of America. The *Handbook* provides directions for locating major arteries in the body.

109 Boy Scouts of America.

secure the stick to prevent the release of tension and reminded not to leave the tourniquet on for more than an hour.[110] Recognizing the potential for serious injury while hiking, rafting, building a fire, cutting wood, or other activities, the Boy Scouts of America made sure that its scouts were prepared and properly trained on how to stop a severe bleed when they were potentially miles from proper medical attention.

Similarly, the Civil Defense legislation provided recommendations for preparedness in the 1950s. In January 1951, the Federal Civil Defense Act of 1950 became law, and arguably in the frostiest phase of the Cold War.[111] The overarching purpose of the Federal Civil Defense Act of 1950 was to create a systematic way to prepare for and respond to an attack or emergency situation affecting civilians up to and including an atomic exchange, which, at the time, was theorized to be widely survivable.[112]

While the primary concern in many of the Civil Defense documents reviewed was on handling nuclear attack, in the publication *In Time of Emergency: A Citizen's Handbook on…Nuclear Attack…Natural Disasters* from 1968, several pages are dedicated to tourniquet application to stop serious bleeding.[113] To be sure, in a big bold graphic, the words "NEVER!—UNLESS ABSOLUTELY NECESSARY" are written near the section on the tourniquet and its application.[114] The handbook specifies that the primary approach to stopping a severe bleed should be to apply pressure, because the application of a tourniquet increases the likelihood of a limb being permanently injured or eventually amputated.[115] Importantly, the directions state that if a tourniquet must be used, once it is applied, it should not be removed or loosened by any person other than a physician, because the physician will be able to handle the bleeding properly and replace any lost blood as a

---

110 Boy Scouts of America.

111 Federal Civil Defense Act of 1950, Public Law 920, U.S. Statutes at Large 64 (1951): 1245 https://www.hsdl.org/?view&did=456688.

112 Federal Civil Defense Act of 1950.

113 This author combed through dozens of documents to find information specific to tourniquet use and civil defense. Many of the documents reviewed can be found at http://www.civildefensemuseum.com/docs.html. See also Office of Civil Defense, *In Time of Emergency*, 61.

114 Office of Civil Defense, 61.

115 Office of Civil Defense, 61.

result of removing the tourniquet.[116] This important point harkens back to discussions in the late 19th and early 20th centuries that warned of the major complications from tourniquets being manipulated by non-medical professionals outside a sterile medical environment.

2. Modern Public Access to Hemorrhage-Control Training

Today, medical professionals use a branded presentation for the lecture portion of the B-Con course, and then adjourn to a tourniquet and wound packing station to teach the hands-on portion of the class.[117] However, many of the concepts and specific information included in the first edition of the *Boy Scout Handbook* from 1911 are still taught in those modern hemorrhage-control trainings. For example, such tenets as emphasizing that a tourniquet should not be left on for an excessive amount of time or that a tourniquet should only be removed by a physician echo in the comparable teachings today. Typically, the B-Con course is delivered in roughly an hour by medical professionals to a group of students in a ratio of 1:8.[118] Hemorrhage-control trainings are designed to be delivered in schools, universities, large public spaces, and communities across the country. For reference, the American Heart Association's Basic Life Support (BLS) for Healthcare Providers course that provides training on cardiopulmonary resuscitation and automated external defibrillator use recommends a ratio of 1:6.[119] Students complete the course and are considered successful if they are capable of demonstrating the practical skills on a model limb taught in the course in a satisfactory manner.[120] The students are expected to stop blood flow through a model leg or arm that replicates a major bleed. The students must demonstrate that they are capable of properly applying a tourniquet or pressure to the wound and can effectively stop the bleeding.

---

116 Office of Civil Defense, 61–62.

117 American College of Surgeons, "Bleeding Control Basic (BCon) Course v. 1.0."

118 American College of Surgeons.

119 American Heart Association, *2011 Basic Life Support (BLS) for Healthcare Providers Classroom Course & Materials Frequently Asked Questions (FAQs)* (Dallas, TX: American Heart Association, 2011), 3, https://www.heart.org/idc/groups/heart-public/@wcm/@ecc/documents/downloadable/ucm_427486.pdf.

120 American College of Surgeons, "Bleeding Control Basic (BCon) Course v. 1.0."

The B-Con course serves two main goals. The first goal that a participant must develop is the ability to identify and recognize a bleeding incident that may result in death.[121] Second, the participant must be able to stop the bleed.[122] Specifically, the participant needs to provide pressure packing or a tourniquet to an injury to prevent exsanguination.[123] As a result, the training focuses on three specific tactics that help stop the bleeding and prevent death: providing pressure, packing a wound, and applying a tourniquet.[124]

The B-Con training is generally broken into two parts, including lectures and hands-on training. The lecture portion of the B-Con training begins with an overall description about why the training is needed. The presenter specifies that the number one cause of preventable death after an injury is bleeding.[125] The presenter continues the lecture by providing the individuals taking the training with the important information that oftentimes EMS response times far exceed the time it takes for someone to bleed to death.[126] Furthermore, emphasis is placed on the importance of the immediate responder. For the purposes of B-Con training, the immediate responder is defined as an individual who has been trained and is able to provide the necessary aid to a person suffering from a severe bleed.[127] The training continues by specifying that the first step in providing any type of first aid is to ensure that the area is safe.[128] The presenter is tasked with making the case that it is impossible for people to provide first aid to an injured individual if they themselves are not in a safe environment. The participants are taught that if they determined an

121 PrepMedic, "Stop the Bleed (Full Course)."

122 PrepMedic.

123 American College of Surgeons, *Bleeding Control (B-Con) Basic* (Chicago: American College of Surgeons, 2017), https://www.jaxsmp.com/wp-content/uploads/2017/02/Bleeding-Control-Basic-Instructor-Presentation-Notes-PPT.pdf.

124 American College of Surgeons.

125 Peter T. Pons and Lenworth Jacobs, "What Everyone Should Know to Stop Bleeding after an Injury," American College of Surgeons, 3, 2017, https://www.bleedingcontrol.org/-/media/bleedingcontrol/files/stop-the-bleed-booklet.ashx.

126 PrepMedic, "Stop the Bleed (Full Course)."

127 PrepMedic.

128 American College of Surgeons, *Bleeding Control (B-Con) Basic*.

environment is unsafe, they should attempt to move to safety and if possible move the victim as well.[129] The curriculum makes it clear that if an immediate responder were trying to render aid to an injured person in an unsafe environment, it is possible that this person may also be injured.[130] Adding another injured person to an already dangerous situation will only make it more difficult for medical professionals to help once they do arrive.

Once the area has been rendered safe, and the immediate responder is able to provide aide, B-Con advocates for the use of what the program refers to as "ABCs of bleeding control."[131] "A" stands for "alert 911."[132] In a chaotic or traumatic situation, it is easy for people to forget or assume that someone else is calling 911; the "diffusion of responsibility" at work as discussed in the Genovese case.[133] "B" means "identify bleeding."[134] Aside from finding the location of the bleed, the immediate responder is expected to identify if it is a continuous bleed, a large volume of blood, and pooling of blood around the injury or coming from the injury.[135] Finally, "C" stand for "compress or provide pressure" to the wound.[136] During this portion of the training, the trainer provides specific examples of how to apply pressure to a wound and stresses that immediate responder should pay attention to the location of bleeding and use sufficient gauze or cloth to cover the injury. Furthermore, once pressure is applied, even if the bleeding stops, it is important for the immediate responder to continue to put pressure on the wound until professional medical help arrives.[137]

Depending on the type of wound, the curriculum recommends the use of a tourniquet to apply pressure and stop bleeding. The curriculum includes several different

---

129 PrepMedic, "Stop the Bleed (Full Course)."

130 PrepMedic.

131 American College of Surgeons, *Bleeding Control (B-Con) Basic*.

132 American College of Surgeons.

133 Latané and Darley, "Group Inhibition of Bystander Intervention in Emergencies," 221.

134 PrepMedic, "Stop the Bleed (Full Course)."

135 American College of Surgeons, *Bleeding Control (B-Con) Basic*.

136 PrepMedic, "Stop the Bleed (Full Course)."

137 PrepMedic.

types of tourniquets, but the STB campaign advocates for the use of a standard CAT and provides a list of suggested tourniquets in the standard B-Con curriculum. Figure 2 offers examples of different types of tourniquets.

Figure 2. Examples of Modern Tourniquets.[138]

As tourniquets A and B in Figure 2 illustrate, modern CATs are essentially a fabric cuff with a stick or rod attached that allows the user to twist and tighten the cuff and apply pressure to stop the flow of blood. Modern CATs do not weigh much, are easy to carry, and, most importantly, easy to apply.[139] New CATs are shown to be applied correctly more often than other improvised or complicated tourniquets.[140]

Determining the correct tourniquet to use or train with is critical. In 2019, McCarty et al. examined four different types of tourniquets to individuals who had received prior training on one specific CAT and asked them to administer them.[141] Based on the performance of the 102 study participants in 2018, the authors suggest that the training is not necessarily translatable across tourniquet types.[142] Specifically, they suggest individuals trained on a specific piece of equipment are not necessarily able to translate

138 Source: Justin C. McCarty et al., "Effectiveness of the American College of Surgeons Bleeding Control Basic Training among Laypeople Applying Different Tourniquet Types: A Randomized Clinical Trial," *JAMA Surgery* 154, no. 10 (2019): e2, https://doi.org/10.1001/jamasurg.2019.2275.

139 Welling et al., "A Brief History of the Tourniquet," 289.

140 McCarty et al., "Effectiveness of the American College of Surgeons Bleeding Control," e4.

141 McCarty et al., e1.

142 McCarty et al., e6.

those learned skills to other equipment or improvised tourniquets, like a rope and a piece of pipe.[143] The findings provide support for two options. The first, which the STB campaign appears to favor, is to encourage or provide all participants that complete B-Con with a CAT or buying options. The second is to increase training time and training participants on the use of multiple types of tourniquets and the creation and use of improvised tourniquets. Based on McCarty et al.'s aforementioned findings, providing a specific CAT to training participants that is easy to carry seems more feasible than training participants on every possible iteration of a tourniquet.

3. Stop the Bleed in Action

Several mass casualty events and emergency situations illustrate the importance of bystanders and their willingness to help. The Boston Marathon bombing in 2013 illustrated a high rate of survival for the injured due to the immediate response of bystanders.[144] After the detonation of the improvised explosives in Boston, early panic was quickly overcome by the quick action of bystanders.[145] Bystanders and first responders quickly converged in the devastated areas and managed to help the injured and transport those in desperate need of medical care to local hospitals.[146] Similarly, after the earthquake in Haiti, 71 percent of those hurt stated that someone close to them personally had helped them in their time of need, yet only one percent reported being helped by a professional.[147] Many of these immediate responders were probably at home or going through the motions of their daily lives when they were suddenly called to action.

In a story covered in 2019, reporters covered a program being rolled out in the South Side of Chicago in which teenagers were learning how to apply tourniquets in case

143 McCarty et al., e5–6.

144 Faul, Aikman, and Sasser, "Bystander Intervention," 2.

145 Arthur L. Kellermann and Kobi Peleg, "Lessons from Boston," *New England Journal of Medicine* 368, no. 21 (2013): 1956–57, https://doi.org/10.1056/NEJMp1305304.

146 Kellermann and Peleg, 1956–57.

147 Faul, Aikman, and Sasser, "Bystander Intervention," 2.

they witnessed or were a victim of a shooting in their neighborhoods.[148] The program is a youth-led antiviolence group called "Good Kids Mad City."[149] The purpose of the group is to provide life-saving skills to teens. From 2011 to 2018, 1,700 kids under the age of 17 suffered a gunshot wound, and 174 of those died as a result.[150] While the exact numbers of youth who have participated in the program are not provided, the course consists of teaching children how to handle a gunshot wound, including how to apply pressure, check a pulse, and do chest compressions.[151] One of the youths who regularly takes part in the program highlighted the fact that if he is ever shot or he sees a shooting, he can give life-saving support to them or even save himself.[152]

Chicago is not the only location that sees the value in STB-type training. In a story highlighting a car accident in West Fargo, North Dakota, immediate responders were able to stabilize and save the life of a woman who accidentally crossed the center of a highway and struck a semi-truck.[153] The important part of this incident is that it occurred in a relatively large community and first responders were able to get to the scene of the accident in roughly 10 minutes, but they were not able to extract her from her vehicle for nearly 40 minutes.[154] The quick action of the immediate responders, including trauma surgeon, Dr. Mary Aaland, that day in 2017 helped to stop her bleeding and ultimately saved her life.[155] Aaland teaches STB in her community and regularly tells her participants to get involved, "If you do nothing, he might have a leg, but he'll be dead. You do this [apply a tourniquet]; he might be alive without a leg. But he's alive. That's the whole point."[156] Dr. Aaland is

---

148 Safia Samee Ali, "'They're Like Soldiers': Chicago's Children Are Learning to Save Lives amid the Gunfire," NBC News, July 17, 2019, https://www.nbcnews.com/news/us-news/they-re-soldiers-chicago-s-children-are-learning-save-lives-n1018196?fbclid=IwAR3PPlAcfgKaN96u9ChRxm36v4med6cHTtQ-mgD0IBmHWKtfLGWdjvTd88Y.

149 Ali.

150 Ali.

151 Ali.

152 Ali.

153 Allee Mead, "Trauma Training Initiative Teaches Rural Laypeople How to 'Stop the Bleed,'" *Rural Monitor* (blog), October 3, 2018, https://www.ruralhealthinfo.org/rural-monitor/stop-the-bleed/.

154 Mead.

155 Mead.

156 Mead.

major proponent of teaching STB and enabling everybody to learn the skills needed to save a life in an emergency.

In sum, it appears that two main factors have prevented the early proliferation of the tourniquets, (1) minimal access to functional, properly manufactured tourniquets, and (2) the misattribution (to the device, rather than the user) of injuries resulting from tourniquet use. Tourniquets, like the screw-type tourniquet, were successfully used in controlled operating room environments for centuries, likely due to the environment including doctors and resources to handle medical emergencies properly.[157] With tourniquets being fashioned in the field, errors in application and exceeding suggested duration were common.[158] Thanks to the development of a proper training curriculum and light, easy-to-operate tourniquets, modern hemorrhage control techniques, including tourniquet use, are embraced and lauded by military and first responders alike.

Thankfully, the TCCC and modern CATs addressed the two major problems facing large-scale tourniquet use on the battlefield and by first responders. Training like the TCCC provided guidelines on the use and application of tourniquets to control bleeding and prevent death in the battlefield.[159] The creation of an easy to use and easy to carry CAT was arguably the critical addition that resulted in the broad adoption of the TCCC and tourniquet use, because it unquestionably stopped bleeding and prevented unnecessary deaths.[160] With proper training and use of the CAT during the conflicts in Iraq and Afghanistan, the gnarly reputation of the tourniquet finally changed to positive.[161] It can be expected that lives can be saved if the same trainings and equipment are made broadly available to those neighborhoods and cities plagued with violence.

Teaching individuals how to react to gunshot wounds and major bleeds is critical in urban environments facing gun violence. Importantly, finding ways to spread these types

---

157 Welling et al., "A Brief History of the Tourniquet," 289.

158 Welling et al., 287.

159 Butler, "Military History of Increasing Survival," 60–61.

160 Butler, "Two Decades of Saving Lives on the Battlefield," e1564.

161 Butler, e1567–68.

of trainings, even community-based more informal programs like the one described previously in Chicago, will pay dividends in the future. Enabling communities to utilize skills they learn to save the people in their families and neighborhoods can be empowering.

III. COMPARATIVE ANALYSIS: IMMEDIATE RESPONDER PROGRAMS

As Isaac Newton stated in a letter to Robert Hooke in 1676, "If I have seen further it is by standing on the shoulders of giants."[162] In other words, progress in any endeavor is made by learning from the examples and mistakes of those who have tried before. While hemorrhage-control training is not new, several immediate responder interventions and programs may provide potential guidance in addressing some of the construction, implementation, and dissemination challenges it faces. Moreover, although public-access hemorrhage-control training is relatively unique, other life-saving interventions and training programs—CPR, AEDs, and Naloxone administration in opioid overdoses—are similar enough to provide valuable insight. This chapter draws parallels—as well as important distinctions—among these programs and hemorrhage-control training in implementation, evaluation, dissemination, equipment, and continued certification to heterogeneous groups of stakeholders. Overall, each intervention stresses the importance of training individuals to respond rapidly and effectively in emergency situations.

A. CARDIOPULMONARY RESUSCITATION

A universal approach to responding to a cardiopulmonary event, the CPR technique is essential for first responders, as well as civilians across the globe.[163] The American Heart Association developed and began dissemination of CPR in 1960, first training physicians and then moving quickly to expand its use among the general public. Cardiopulmonary resuscitation uses chest compressions and artificial modes of ventilation or breathing to

162 Gary Martin, "'Standing on the Shoulders of Giants'—the Meaning and Origin of This Phrase," Phrasefinder, accessed September 12, 2020, https://www.phrases.org.uk/meanings/268025.html.

163 P. P. Saramma et al., "Assessment of Long-Term Impact of Formal Certified Cardiopulmonary Resuscitation Training Program among Nurses," *Indian Journal of Critical Care Medicine* 20, no. 4 (April 2016): 226–32, https://doi.org/10.4103/0972-5229.180043; Audrey L. Blewer et al., "Cardiopulmonary Resuscitation Training Disparities in the United States," *Journal of the American Heart Association* 6, no. 5 (May 5, 2017), https://doi.org/10.1161/JAHA.117.006124.

assist those who have suffered a cardiac arrest or any other event that has caused the heart to stop pumping blood.[164]

CPR is a program that has allowed people with little or no medical training to step in and provide life-saving care when someone is in need.[165] CPR programs illustrate that when individuals are trained properly and quickly intervene during a cardiac emergency, they save lives.[166] In fact, research has shown that victims of cardiac arrest are up to four times more likely to survive if they receive proper, rapid CPR before getting to a hospital.[167]

1. Training Type/Mode

CPR training provides the participant with the knowledge to identify a cardiac arrest and properly respond with a life-saving intervention. The basics of CPR response include making sure the scene is safe, touching the victims to see if they are responsive, evaluating whether the victims are breathing, calling (the responders) for help, and applying an AED if available.[168] After spending time learning about the signs associated with cardiac arrest, the participants learn how to apply chest compressions properly.[169] The instructors teach the participants to provide compressions at the right tempo and the correct position and depth.[170]

Cardiopulmonary resuscitation is delivered to participants through a number of different modes. Learning CPR through lecture, in-person instruction, or video provides

---

164 Shou-Chien Hsu et al., "The Effectiveness of Teaching Chest Compression First in a Standardized Public Cardiopulmonary Resuscitation Training Program," *Medicine* 98, no. 13 (March 2019): 1, https://doi.org/10.1097/MD.0000000000014418.

165 David Weidenauer et al., "The Impact of Cardiopulmonary Resuscitation (CPR) Manikin Chest Stiffness on Motivation and CPR Performance Measures in Children Undergoing CPR Training—A Prospective, Randomized, Single-Blind, Controlled Trial," *PLOS ONE* 13, no. 8 (August 16, 2018): 2, https://doi.org/10.1371/journal.pone.0202430.

166 Hsu et al., "The Effectiveness of Teaching Chest Compression First," 1.

167 Weidenauer et al., "The Impact of Cardiopulmonary Resuscitation (CPR) Manikin Chest Stiffness on Motivation," 2.

168 Hsu et al., "The Effectiveness of Teaching Chest Compression First," 3.

169 Hsu et al., 2.

170 Hsu et al., 3.

class participants with the skills necessary to identify a cardiac arrest and how to begin an emergency response.[171] Some experts have argued that the formality required to deliver in-person, fee-based training to non-medical professionals is outdated and may no longer be the best way to deliver life-saving skills.[172] Potentially, a hybrid approach of initial in-person training and online refresher training could be effective, but no current research was identified that examines this approach.

Ultimately, ensuring that participants are able to retain the skills learned in training and use them in an emergency situation is one of the most important parts of CPR training. Data show that simply participating in CPR training helps to boost the likelihood that a person will intervene and attempt to save a person suffering from a cardiac arrest.[173] The length of time that the training is retained is a crucial variable. Research conducted within a group of nurses illustrates that skills taught in basic life-saving skills training, including CPR, are not necessarily retained well over long periods, so participants are required to renew the training and recertify periodically.[174] While the sample for this particular study was a group of nurses, the findings suggest that retainability might be even less among non-medically trained individuals. Defining what is the acceptable level of retention for non-medically trained people is potentially important.

Cardiopulmonary resuscitation is taught to young children in scouting programs, lifeguards, medical professionals, and laypeople.[175] Data show that trainings should be delivered to people and communities the most likely to experience a potential cardiopulmonary event. Based on recent studies, CPR training has been disproportionately delivered to more affluent populations, which eliminates those from lower socioeconomic

---

171 Hsu et al., 2.

172 Richard Lazar, "Reimagining CPR Training to Enable More Real-World Applications," Occupational Health & Safety, February 1, 2020, https://ohsonline.com/articles/2020/02/01/reimagining-cpr-training-to-enable-more-realworld-applications.aspx.

173 Pivač, Gradišek, and Skela-Savič, "The Impact of Cardiopulmonary Resuscitation (CPR) Training on Schoolchildren."

174 Saramma et al., "Assessment of Long-Term Impact of Formal Certified Cardiopulmonary Resuscitation Training Program among Nurses," 231.

175 Pivač, Gradišek, and Skela-Savič, "The Impact of Cardiopulmonary Resuscitation (CPR) Training on Schoolchildren."

backgrounds and those less-educated or older members of the population.[176] The unequal delivery of training is a significant point of concern. Ensuring vulnerable populations at higher risk for conditions that require medical attention receive training—for example, CPR—can help save lives that may otherwise be lost. It is reasonable to assume that older adults are most likely to suffer cardiac arrest incidents. Training family members or companions of elderly Americans may be pivotal in providing the necessary intervention to keep a person alive long enough for professional medical attention to arrive. By targeting hot spots of vulnerability and identifying individuals most likely to encounter those at risk, CPR training and the lifesaving effects of the technique may be maximized.

2. Certification

Ensuring that participants can illustrate lasting competency is one of the main drivers for certification. Once individuals illustrated that they are capable of deploying the skills learned in training, they are issued a course card or proof of successful completion.[177] Cardiopulmonary resuscitation requires that participants be recertified to ensure they retain the knowledge and skills learned in training. Certification cards issued by such organizations as the American Heart Association are valid for two years.[178] By having to retrain and practice the necessary skills to be recertified, individuals can maintain their ability to deliver lifesaving aid effectively.

3. Equipment

Cardiopulmonary resuscitation does not require any special equipment or technology. In most cases, all that is needed are the immediate responder's hands. However, individuals can use mouth covers or special fittings to give rescue breaths; in the event of a serious emergency, this equipment is not absolutely necessary to save a life.

---

176 Blewer et al., "Cardiopulmonary Resuscitation Training Disparities in the United States."

177 "Emergency Cardiovascular Care Course Card Reference Guide," American Heart Association, 3, November 2019, https://cpr.heart.org/-/media/cpr-files/resources/course-card-information/course-card-reference-guide-kj0916.pdf?la=en.

178 American Heart Association, 3.

4. Summary

Overall, the model for delivering CPR training has been used for roughly 60 years, and research provides support for new approaches to training.[179] In addition, some experts have raised concerns about the retention of training and delivery to those closest to people at highest risk. Since the current model arguably fails to reach the maximum number of people possible, large portions of the population, including those in contact with most high-risk communities, are missing out on learning the skills taught in CPR classes and the confidence boost that comes with the knowledge. As the goal of CPR training should be to provide a functional level of understanding to get laypeople to act and save lives, given the retention concerns and limited access, focusing on the perfect delivery of training and certification may not be the most practical choice.[180] Making the training as accessible as possible to the largest number of participants is the most important lesson from the CPR curriculum.

B. AUTOMATED EXTERNAL DEFIBRILLATION

The use of automated external defibrillators is a relatively new intervention for acute cardiac emergencies. In a pooled study of roughly 13,000 incidents of cardiac arrest, those individuals receiving treatment from an AED had a survival rate of 24 percent.[181] Other national programs outside of the United States report rates of survivability between 15 percent and 50 percent.[182] The research indicates that the AED is tool that can save lives.

A portable self-contained tool, AED equipment consists of a shoebox-sized unit with two adhesive pads applied to the chest, for use by medical and non-medical personnel

179 Lazar, "Reimagining CPR Training to Enable More Real-World Applications."

180 Lazar.

181 Austin S. Kilaru et al., "Use of Automated External Defibrillators in U.S. Federal Buildings," *Journal of Occupational and Environmental Medicine/American College of Occupational and Environmental Medicine* 56, no. 1 (January 2014): 7, https://doi.org/10.1097/JOM.0000000000000042.

182 Kilaru et al., 7.

alike.[183] The device delivers an electric shock to restart the rhythm of the heart. AEDs are equipped to allow immediate response by untrained individuals to help save lives. To use them, the user must follow the directions attached to the AEDs or dictated aloud by the machine itself. Figure 3 illustrates a common AED and its application on a training model.

Figure 3. AED Equipment and Placement.[184]

1. Training Type/Mode

Although the American Heart Association provides training for AEDs, prior education is not absolutely necessary for a person to use them properly. When training is provided, the use of the AED is often paired with CPR training and delivered in a

183 "AED Programs Q&A," American Heart Association, 2018, https://cpr.heart.org/-/media/cpr-files/training-programs/aed-implementation/aed-programs-qa-ucm501519.pdf?la=en.

184 Source: LifeSaving CPR Trainer, "How to Use an AED—Life Saving CPR Training Blog," *Life Saving CPR* (blog), accessed July 11, 2020, https://cprlifesaving.wordpress.com/2018/03/02/how-to-use-an-aed/.

"Heartsaver" course.[185] The main argument for formal AED training involves the need to teach individuals to identify signs of a cardiac arrest or a situation in which AEDs should be used.[186] Since AEDs do not necessarily require any formal training or certification, instructions for use appear on the device. Nevertheless, successful deployment of the device requires people to read the directions on the device or understand the audible prompts provided. Figure 4 provides an example of instructions provided on an AED.

Figure 4. Sample AED Instructions.[187]

2. Certification

The American Heart Association does provide training and two-year certification for those whose organizations require it: teachers, social workers, local EMS, fire personnel, and police.[188] Importantly, certification in this capacity does not necessarily

185 American Heart Association, "AED Programs Q&A."

186 American Heart Association.

187 Source: LifeSaving CPR Trainer, "How to Use an AED—Life Saving CPR Training Blog."

188 American Heart Association, "Emergency Cardiovascular Care Course Card Reference Guide," 3.

predict how well a person will perform the skills learned nor does it provide a clear assessment of proficiency.[189] The American Heart Association does recommend training and certification through the "Heartsaver" program it provides for any organization wanting to purchase and make an AED available in its building or location.[190]

3. Equipment

AEDs are often located in buildings on walls similar to fire extinguishers or first-aid kits. They are useful tools and can have a dramatic effect on survivability, but bystanders must have access to them to save lives. Passed in 1999, the Cardiac Survival Act requires that an AED be placed in all federal buildings.[191] The Community Access to Emergency Devices Act, which passed three years later, requires that Congress provide funds to local and state governments to buy and place AEDs in public places for emergency use.[192] For example, as of 2014, approximately 3,250 AEDs have been placed in roughly 1,000 federal buildings throughout the United States.[193]

4. Summary

AEDs are wonderful tools with the ability to save the lives of those suffering from cardiac arrest. Notably, the equipment is advanced enough for even a person with little or no training to use it successfully if following the written or audible instructions provided by the machine. The tool can be used in addition to other life-saving techniques like CPR, and together, they can have a dramatic impact on the survivability of a cardiac arrest. Most importantly, AEDs provide a great example of lifesaving technology that requires little or no training thanks to the ease of use.

---

189 Lazar, "Reimagining CPR Training to Enable More Real-World Applications."

190 American Heart Association, "AED Programs Q&A."

191 Frank A. Leeb, "Saving the Savable: Using Bystanders to Increase Survival from out-of-Hospital Cardiac Arrest (OHCA) in New York City" (master's thesis, Naval Postgraduate School, 2016), 6.

192 Leeb, 6.

193 Kilaru et al., "Use of Automated External Defibrillators in U.S. Federal Buildings," 6.

C. INTRANASAL NALOXONE ADMINISTRATION

As a result of decades of opioid misuse and overdose deaths, the Department of Health and Human Services declared opioid overdoses a public health emergency in 2017.[194] As part of the department's approach to combating the opioid epidemic, the drug Naloxone, known by the brand name Narcan, has become more accessible and widely available.[195] Naloxone in nasal spray form is capable of reversing the effects of an opioid overdose and easy to administer.[196]

1. Training Type/Mode

As with AEDs, naloxone requires little or no training beyond the instructions on the side of the packaging containing two doses to save lives.[197] Nevertheless, most distribution of the drug includes some sort of training, albeit brief, that shows how to administer Naloxone intranasally. These trainings also serve as touch points to distribute the medication to individuals, as well as secondary distributions to organizations and groups that work directly with communities at high risk of opioid overdose. One such example is the MO-Hope project, developed to focus on the staggering number of opioid deaths in Missouri, 1,132 in 2018 alone.[198]

The MO-Hope training program in Missouri initially provides the training participant with the ability to identify an overdose.[199] As instruction during the training states and similar to CPR and AED, the first step to saving the person suffering from overdose is to call 9-1-1.[200] The instructors recommend that while waiting for EMS, the

194 "What Is the U.S. Opioid Epidemic?," U.S. Department of Health and Human Services, December 4, 2017, https://www.hhs.gov/opioids/about-the-epidemic/index.html.

195 "Secretary Price Announces HHS Strategy for Fighting Opioid Crisis," Department of Health & Human Services, April 19, 2017, https://www.hhs.gov/about/leadership/secretary/speeches/2017-speeches/secretary-price-announces-hhs-strategy-for-fighting-opioid-crisis/index.html.

196 David Tan and Jeff Siegler, "Mo-Hope Project: Naloxone Antidote Administration for Suspected Opioid Overdose," Mo-Hope Project, August 27, 2019, 21–23.

197 The Narcan packaging contains the instructions for use and two doses of Narcan in blister packs.

198 Tan and Siegler, "Mo-Hope Project," 8.

199 Tan and Siegler, 17.

200 Tan and Siegler, 17.

immediate responder should administer Naloxone to get the person breathing again.[201] In the event that the initial dose does not revive the person suffering from an overdose, Naloxone can be administered more than once without concern of an overdose. If a person does not respond to the first dose, it is recommended that a second dose be administered.[202] Similar to instructions for AEDs, those for Naloxone are placed on the packaging, as illustrated in Figure 5.

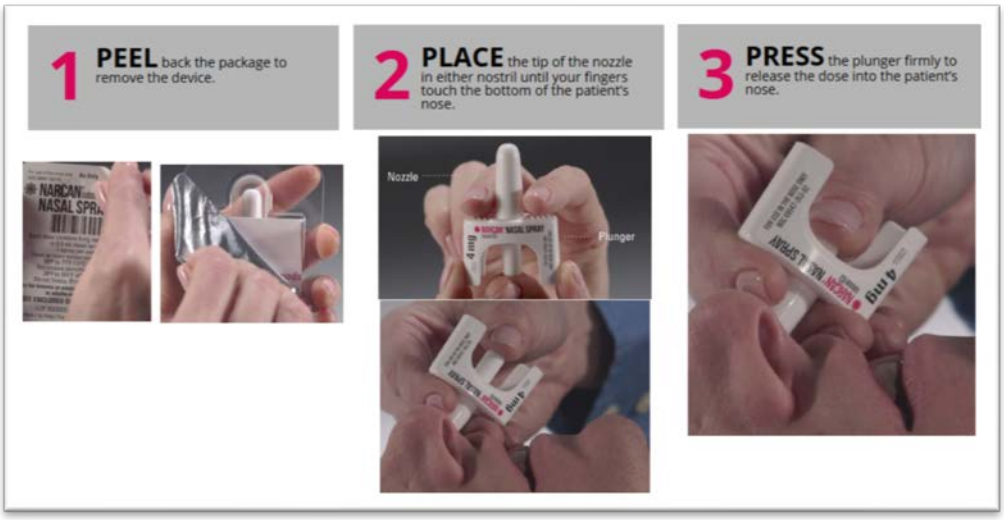

Figure 5. Intranasal Naloxone Administration Instructions.[203]

While training is not absolutely necessary, some states have opted to provide funding to develop Naloxone training programs. With the CARES Act and the federal and state opioid response over the past five years, funding for, training in, and distribution of Naloxone have increased significantly. The MO-HOPE project has trained 7,600 people and distributed nearly 20,000 doses of Naloxone, which resulted in 2,300 lives saved from December 2016 to March 2019.[204]

201 Tan and Siegler, 19.

202 Tan and Siegler, 26.

203 Source: Tan and Siegler, 23.

204 Tan and Siegler, 1.

2. Certification

While many first responders and medical professionals complete training, certification is unnecessary to administer Naloxone. The drug is provided, however, to those completing training, but notably, individuals may buy it from a local pharmacy without training or a prescription.[205]

3. Equipment

For immediate responders to save lives, they must have Naloxone to spray into the nostrils of individuals suffering from overdose. In many cities across the country, the drug is being provided to families and friends of opioid users, and in some cases, to opioid users themselves; thus, targeting individuals and populations at highest risk.[206] Even as early as 2009, thousands of doses of Naloxone had been distributed, which resulted in the reversal of hundreds of overdose deaths.[207] First responders are also encouraged to carry the drug in the event that they are accidentally exposed to opioids and experience symptoms of overdose.[208]

4. Summary

Harm-reduction strategies have the goal of putting the life-saving drug in the hands of those who need it most, targeting cities like Chicago, San Francisco, New York, and Baltimore, to name a few.[209] Programs also exist in Germany and Britain, where opioid use is prevalent.[210] In Missouri, the Mo-Hope project and other similar initiatives have

---

205 Janet Weiner, Sean M. Murphy, and Czarina Behrends, "Expanding Access to Naloxone: A Review of Distribution Strategies," Penn LDI, Leonard Davis Institute of Health Economics, May 29, 2019, https://ldi.upenn.edu/brief/expanding-access-naloxone-review-distribution-strategies.

206 Laura Starecheski, "Teaching Friends and Family How to Reverse a Drug Overdose," NPR, December 29, 2014, https://www.npr.org/sections/health-shots/2014/12/29/371770229/teaching-friends-and-family-how-to-reverse-a-drug-overdose.

207 Daniel Kim, Kevin S. Irwin, and Kaveh Khoshnood, "Expanded Access to Naloxone: Options for Critical Response to the Epidemic of Opioid Overdose Mortality," *American Journal of Public Health* 99, no. 3 (March 2009): 405, https://doi.org/10.2105/AJPH.2008.136937.

208 Tan and Siegler, "Mo-Hope Project," 4.

209 Kim, Irwin, and Khoshnood, "Expanded Access to Naloxone," 405.

210 Kim, Irwin, and Khoshnood, 405.

prioritized training and distribution to those most likely to encounter someone in active drug use at risk for an overdose. Evidence has shown that simply teaching individuals to identify an overdose, place the applicator in the victims nose, and push the plunger has a lifesaving effect.[211] Making sure that immediate responders have the necessary tools to save a life in their possession is most important.

D. ANALYSIS

Each intervention discussed stresses the importance of training individuals in how to respond rapidly and effectively in an emergency situation. Empowering the average person with the skills needed to take action when a given emergency occurs is the ultimate goal of any immediate responder program. Table 1 illustrates several key components in each program discussed in this chapter.

Table 1. Intervention Components

	Training Type	Is retraining recommended over time?	Certification exists	Specialized Equipment/ Placement
CPR	Multiple forms but usually includes in-person instruction	Yes	Available not required	Available not required
AED	Not required but may be combined with CPR training under the Heartsaver course	Available not required	Available not required	Yes
Narcan/ Naloxone	Not required but may be provided	Available not required	Available not required	Yes
Hemorrhage-Control	Multiple forms but usually includes in-person instruction	Yes	Available not required	Available not required

Table 1 illustrates that some of the programs discussed do have some overlapping similarities while having some important differences. Although public-access hemorrhage-control training is relatively unique, CPR, AED, and Naloxone administration in opioid overdoses are similar enough to provide valuable insight. For example, some, like AED, require specific equipment, and others, like CPR and Narcan, provide various methods to teach each training, including in-person and online options.

211 Tan and Siegler, "Mo-Hope Project," 3.

In sum, and drawing on the commonalities illustrated in Table 1, the first priority when developing any immediate responder program should be to make training more easily accessible to the most people possible. If people cannot easily access training, it is a missed opportunity for them to gain the skills and knowledge that enable them to act. Second, if specialized equipment is necessary, it must be easy to use and easily accessible, either mounted on walls in public spaces or distributed to users. Equipment should be as intuitive and as simple to use as possible. Moreover, providing prompts via audible directions, as well as easy-to-read instructions, may help a person trying to use the equipment in a stressful situation. Finally, while training is often important, building in natural points of contact for trainers and trainees, like required recertification, may increase retention and the person's ability to apply those lessons learned. Making it as easy as possible to engage people who have learned skills is critical because it may help solidify the information they have learned and may have forgotten overtime. The old adage "If you don't use it you lose it" comes to mind.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. ANALYSIS AND OPTIONS FOR FUTURE HEMORRHAGE-CONTROL TRAINING IN ST. LOUIS

This chapter synthesizes the lessons learned from the comparative analysis of similar immediate responder programs and applies them to the specific programmatic needs of St. Louis, which is in the early stages of developing and deploying large-scale hemorrhage control training. With a history of testing and piloting focused intervention programs and efforts to curb violence, St. Louis is an excellent place to deploy the efforts described in this chapter. The overarching goal is to inspire the development of a plan of action and define possible operational metrics for success to provide adequate data for future researchers who will evaluate the program.

A. ASSESSING ST. LOUIS

Quickly providing emergency medical attention to the victim of a gunshot is critical.[212] The evidence supports that the longer a traumatic wound is left unattended, the more likely a person is to die from that wound; moreover, the faster the application of stabilizing treatment, the more likely the person is to survive.[213] For gunshot wounds and other injuries requiring hemorrhage control, the use of tourniquets can prove to be life-savers. While data collection regarding hemorrhage-control training is still in it is infancy compared to other immediate responder programs, the existing data suggest that prehospital tourniquet use may reduce the likelihood of death by nearly six times.[214] The evidence is certainly in favor of providing laypeople with the skills and equipment necessary to provide livesaving care in the event of a shooting resulting in a major bleed.

212 Chambers et al., "'Stop the Bleed,'" 67; Levy, "Public Access Bleeding Control," 235.

213 Smith and Delaney, "Supporting Paradigm Change in EMS' Operational Medical Response to Active Shooter Events," 50.

214 Pedro G. R. Teixeira et al., "Civilian Prehospital Tourniquet Use Is Associated with Improved Survival in Patients with Peripheral Vascular Injury," *Journal of the American College of Surgeons* 226, no. 5 (May 1, 2018): 769–776.e1, https://doi.org/10.1016/j.jamcollsurg.2018.01.047.

Implementing a hemorrhage-control training program in the hopes of saving lives will likely have positive impacts on lives and communities. The following issues represent hurdles that must be overcome to create an effective program in St. Louis.

1. Concentrated Areas of Violent Crime

Developing or adjusting cost-effective hemorrhage-control training to be delivered in person to those most likely to be affected by gun violence may provide the skills necessary to affect the survivability of a shooting dramatically, and subsequently, neighborhood dynamics and homicide rates. Including hemorrhage-control training in such existing interventions to address crime as focused deterrence programs may disseminate the information to those who can use it most. Typically, problem-oriented interventions, like focused deterrence programs, include very diverse solutions to the problem of crime.[215] In this case, typical criminal justice methods may not provide the answer to prevent a shooting, but using the skills learned in hemorrhage-control training, participants may prevent a homicide by preventing a death from exsanguination after a shooting.[216]

Several media outlets have report that St. Louis has the second-highest homicide rate among major U.S. cities with 64.21 homicides per 100,000 residents.[217] For the purposes of internal analysis, the SLMPD has merged homicide and aggravated assaults with a gun together, because the factors precipitating these crimes are often similar. St. Louis is faced with above-average levels of violence, especially gun violence. In the first half of 2019, 72 violent crimes per 10,000 residents occurred.[218] Since 2015, St. Louis has experienced a dramatic increase in person crimes, specifically homicides and aggravated

215 Anthony A. Braga et al., "The Strategic Prevention of Gun Violence among Gang-Involved Offenders," *Justice Quarterly* 25, no. 1 (March 2008): 156, https://doi.org/10.1080/07418820801954613.

216 Michelle Tsui et al., "Stop the Bleed: Gap Analysis and Geographical Evaluation of Incident Locations," *Trauma Surgery & Acute Care Open* 5, no. 1 (February 1, 2020): 1, https://doi.org/10.1136/tsaco-2019-000384.

217 Daniel Hernandez, email message to author, May 13, 2020.

218 Daniel Hernandez.

assaults with guns. St. Louis reached 205 homicides by the beginning of October 2020.[219] With three months remaining, the number of homicides for 2020 already exceeds annual totals from the previous five years.[220] The trending violence for 2020 is concerning when added to violent crime information from previous years. For reference, Figure 6 graphically depicts homicides by year since 2015.

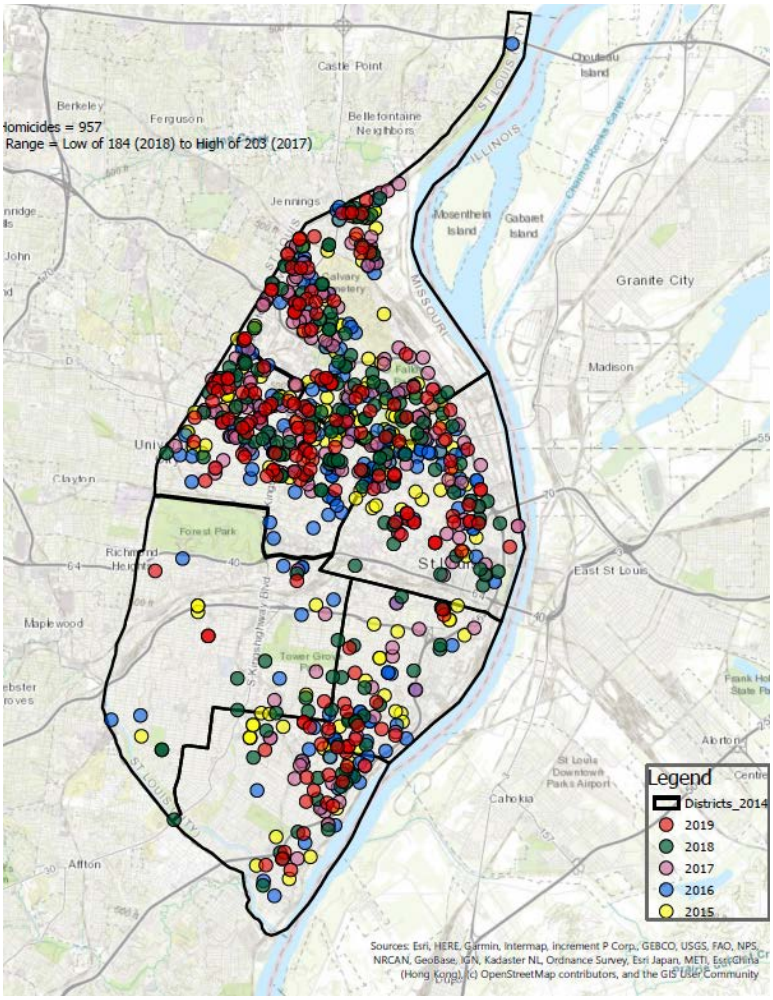

Figure 6. Homicides by District: January 2015–December 2019.[221]

219 St. Louis Metropolitan Police Department, *2020 UCR Homicide Analysis October 3, 2020* (St. Louis, MO: St. Louis Metropolitan Police Department), 1, https://www.slmpd.org/images/Homicide_Stats_for_Website.pdf.

220 St. Louis Metropolitan Police Department, 1.

221 Source: Daniel Hernandez, email message to author, May 13, 2020.

Similar to other urban environments, St. Louis does not see its gun crime equally distributed. Rather, it tends to be concentrated in a band across the north part of the city, with another concentration in the southeast corner of the city. In contrast, gun crimes are infrequent in much of the central and southwest parts of the city. The following maps visualize gun crimes known to the SLMPD from January 1 to December 31, 2019. Figure 7 reflects the number of gun crimes in each of the 79 neighborhoods in the St. Louis City.

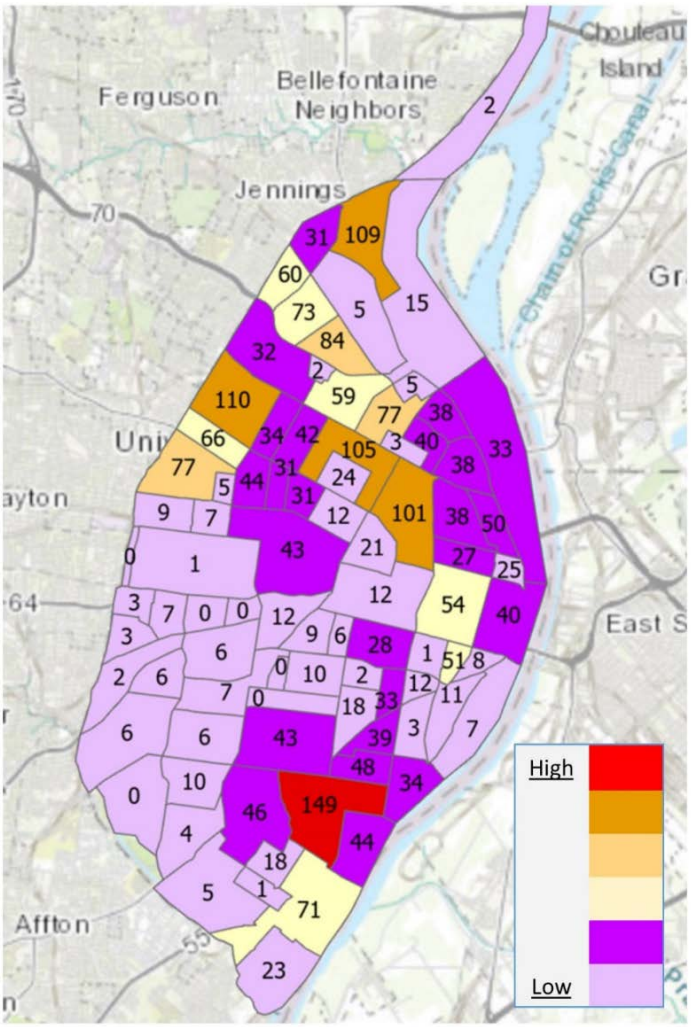

Figure 7. 2019 Gun Crimes by Neighborhood (Raw Number of Gun Crimes Displayed in Each Neighborhood Polygon).[222]

222 Source: Daniel Hernandez.

Figure 8 shows the density of gun crimes, with higher density displayed in darker shading, irrespective of neighborhood boundaries. Notably, both maps reflect raw numbers of incidents, not the rate of incidents as a function of a neighborhood's population.

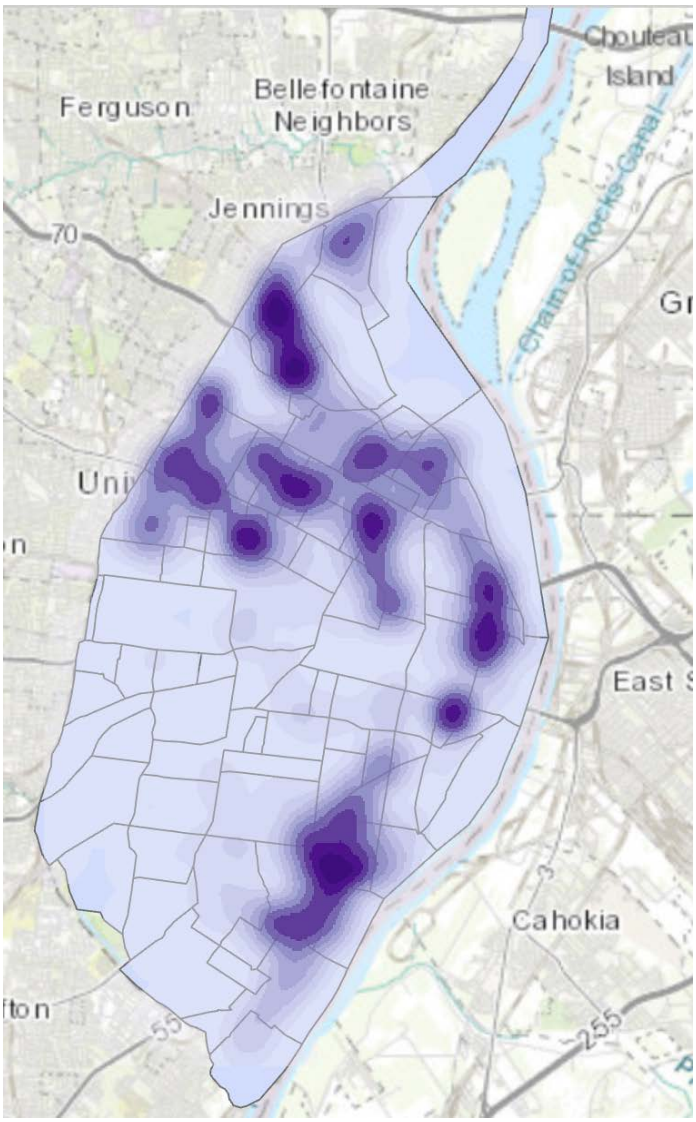

Figure 8. 2019 Gun-Crime Density (Raw Numbers Displayed over Each Neighborhood Boundary).[223]

223 Source: Daniel Hernandez.

Figures 7 and 8 thus both identify areas that possibly need lifesaving interventions like hemorrhage-control training, and the maps provide insight into potential locations on which to focus immediately. Given that the bulk of gun crimes occur on the north side of St. Louis, identifying and partnering with community members and organizations in those neighborhoods are critical. Providing training in southwest neighborhoods of the city would not likely have an impact on the overall lethality of gun crimes due to the minimal number of shootings there.

St. Louis continues to have a high rate of violence regardless of policing interventions, which include specialized enforcement, special enforcement zones, and hot spots over the past five years. Furthermore, violent crime is not randomly distributed throughout the city. More recently, homicides in St. Louis increased from 184 in 2018 to 193 in 2019, which represented a 5-percent increase.[224] Regardless of the measures put in place to prevent homicides and violent crime, solving the crimes that do happen is critical to holding perpetrators of violence accountable; policing remains necessarily more reactive than proactive. Arresting a suspect in a crime is generally referred to as "clearing" it. In 2018, 94 (51.1 percent) homicides were cleared by SLMPD and 76 (39.4 percent) were cleared in 2019.[225] A similar increase happened in aggravated assaults with a gun from 2018 (2,333) to 2019 (2,540), which grew 8.9 percent.[226] Unfortunately, the clearance rate for these crimes decreased by 4.7 percent over that time, from 35.7 percent to 31 percent.[227] The data illustrates how serious the issues facing St. Louis are. With more crimes and fewer arrests, citizens have to deal with feeling unsafe in their homes and neighborhoods.

Holding violent offenders accountable relies not only on arrests but also successful prosecution. Offenders engaging in this type of violent behavior are not typically being held accountable for their actions in a systemic way. In St. Louis, many of these cases are not presented to the Circuit Attorney Office (CAO) for review due to insufficient

224 Daniel Hernandez.

225 Daniel Hernandez.

226 Daniel Hernandez.

227 Daniel Hernandez.

community or witness participation, lack of witnesses, or insufficient evidence. Of the cases presented to the CAO, only half see charges issued.[228] Arguably the low issue rate is due to a lack of evidence or witness participation. The result is a low clearance and conviction rate for homicides and non-fatal shootings in the city of St. Louis, which in turn furthers the divide between community and law enforcement. Most problematically, citizens again have to deal with the fear of violence in their communities and those responsible not being held accountable.

Obviously, the primary goal of STB-type programming is to save lives by training individuals in the use of tourniquets and pressure application. Hemorrhage-control training can be applied in multiple settings to develop resiliency and aid the response to traumatic injuries caused by gunshots, car accidents, industrial accidents, and any other injuries resulting in major bleeds.[229] However, secondary effects may exist. Empowering the community through programs like STB may prove a starting point for increasing participation in court proceedings and cooperation with police. If community members are able to see that officers are in the communities alongside medical professionals trying to teach life-saving skills, perhaps it may help build community trust. Police and community interactions through programming like STB may be the basis for future police community engagement programs. If better relations can possibly be developed and members of the community most affected by gun violence can learn how to save a person bleeding to death, it is worth the effort.

Community outreach and training in these vulnerable communities can take many different shapes. For example, law enforcement personnel with assistance from medical professionals reaching out to community centers, churches, schools, and other neighborhood mainstays to partner in providing training is one possible way to reach as many people as possible. Similarly, these same neighborhood stakeholders can possibly provide a location for additional storage of trauma kits and supplies to be distributed to the

228 Daniel Hernandez.

229 Levy, “Public Access Bleeding Control,” 236; Pasley et al., “Stop the Bleed,” 1635.

community. Building lasting relationships in the communities can be one of unintended but beneficial impacts beyond teaching people how to save lives with tourniquets.

2. Compartmentalized Data

The SLMPD maintains a sophisticated crime analysis group. Data available for analysis within the SLMPD include trends of homicides and non-fatal gun assaults. Most crime information is mapped and made available to SLMPD personnel through data dashboards developed and maintained by the Crime Analysis Unit. In addition, SLMPD analysts collect and review aggregate data on case clearance information, victim and witness cooperativeness, and other relevant case information.

The most glaring data collection deficiency related to this effort is that of gunshot wound (GSW) location on the body. When compared to the data reviewed by Tsui et al., St. Louis does not systematically collect and make available data specific to type of wound and location of the wound on the body.[230] Collecting and evaluating that data will provide a clearer picture of the potential impact a widespread hemorrhage-control training or focused tourniquet distribution can have. The first major step in widespread hemorrhage-control training or focused tourniquet distribution in St. Louis is to work to collect more data and make it readily available for potential stakeholders. Having these data readily available will make it easier to estimate the impact that the proposed expansion of hemorrhage-control training may have on the most vulnerable communities in St. Louis.[231] For example, if a large proportion of victims are dying as a result of a GSW to the chest or head, where a tourniquet is not applicable, the impact of widespread hemorrhage-control training or focused tourniquet distribution may be minimal.

Similarly, data relative to injured officers and their personal use of tourniquets are not readily available for further analysis. One such example includes an SLMPD officer assigned to a specialized unit who was recently shot in the leg, and the officer was saved

---

230 Tsui et al., "Stop the Bleed," 3.

231 St. Louis—specific information is derived from the author's experience in the field over the past eight years. Such details about St. Louis are not confidential, and the author has permission to reproduce them in this thesis.

thanks to the proper application of two tourniquets. Unless the story makes the local news, little information is available to estimate the effectiveness of tourniquet use by officers. The local St. Louis newspaper, the *St. Louis Post-Dispatch*, covered the shooting of the local officer, and highlighted how the officer saved his own life thanks to the ability to apply his own personally issued tourniquet.[232]

In a recent gap analysis, Tsui et al. estimated the number of victims that might be saved or affected by the use of hemorrhage-control techniques by looking at medical examiner data.[233] The study looked at 139 individuals from Jefferson County, Alabama, between 2013 and 2017.[234] The initial purpose of the study was to plot the information collected on a map to determine the best locations to distribute trauma kits, but the discussion inevitably focused on the overarching question of how to get massive amounts of trauma care supplies to seemingly difficult-to-predict, random locations.[235] Ultimately, the gap analysis illustrates the need for future research and discussion on the potential value of continuing a program like STB.[236]

3. Undefined Measures of Success

As with any intervention, defining operational success allows for the evaluation of program data to ensure the intervention is working and worth the resources. Hemorrhage-control training is not different in that regard. In an article published in early 2020 regarding outcome variables specific to the STB program, Strauss-Riggs et al. argue that to assess STB, it is necessary to collect and assess specific and systematic data gathered for this purpose.[237] However, clearly defining success will take effort. For example, the TCCC

232 Taylor Tiamoyo Harris, "Webster Groves Police Officer Shot along I-44, Suspect Dead," STLtoday, May 6, 2020, https://www.stltoday.com/news/local/crime-and-courts/webster-groves-police-officer-shot-along-i-44-suspect-dead/article_0ef9b2e4-f68b-55b8-93ab-92d61ba43277.html.

233 Tsui et al., "Stop the Bleed," 1.

234 Tsui et al., 2.

235 Tsui et al., 1.

236 Tsui et al., 4

237 Kandra Strauss-Riggs et al., "Recommended Process Outcome Measures for Stop the Bleed Education Programs," *AEM Education and Training*, 2, April 16, 2020, https://doi.org/10.1002/aet2.10443.

gauges success based on the metric of lives saved on the battlefield.[238] Collecting data on the number of individuals saved after a shooting or a severe bleed in the neighborhoods of St. Louis could prove nearly impossible, even without privacy and medical information concerns with which to contend. Strauss-Riggs et al. maintain that tracking reductions in mortality would be the ideal but concede that it would be nearly impossible to do.[239] Even if it were possible to collect that level of data, how many lives saved would be enough to consider the program successful? One? Ten?

Strauss-Riggs et al. provide suggested measures to collect to ensure STB programs evaluate impact, the bulk of which rely on surveys.[240] They suggest collecting EMS data to evaluate whether more bystanders are getting involved and utilizing hemorrhage-control techniques.[241] The researchers recommend surveying immediate responders to analyze the behaviors of individuals who intervened, including what they did specifically, how they knew the bleed was life-threatening, and what course of action they took.[242] Strauss-Riggs et al. give examples of proficiency and satisfaction survey recommendations, but those are not unlike what is utilized in pre/post-tests to illustrate completion of the course.[243] Lastly, the scholars argue for the collection of data specific to the numbers of voluntary participation in training, duration of training, in-person, or some other type of media training, and the number of new and retrained participants.[244]

Any evaluation of efficacy requires that clearly defined metrics be evaluated in a systematic way. In general, metrics by which success may be measured include the successful application of a tourniquet and direct pressure, retention of the skills for some

238 Chambers et al., "'Stop the Bleed,'" 68.

239 Strauss-Riggs et al., "Recommended Process Outcome Measures for Stop the Bleed Education Programs," 2.

240 Strauss-Riggs et al., 2–3.

241 Strauss-Riggs et al., 3.

242 Strauss-Riggs et al., 3.

243 Strauss-Riggs et al., 3.

244 Strauss-Riggs et al., 3.

interval, and transferability of the skills across types of tourniquets.[245] Transferability of the skills across types of tourniquets is a loose metric that may be used to illustrate full understanding and comprehension of the principles of hemorrhage control. Referring back to the first edition of the *Boy Scout Handbook*, published in 1911, emphasis is placed on how to locate an artery and what is necessary to stop the bleeding with only makeshift available tools, not only one type of CAT. However, further discussion regarding this possible metric should be continued. Arguably, finding or fashioning a tourniquet may cost crucial time in which the immediate responder may have been applying manual pressure to the wound.

Ultimately, should large-scale efforts be made in St. Louis to provide STB training in the most violent areas or the areas suffering from the most gun crimes, the major metric for success is likely a reduction in the rate of fatalities from gunshot wounds as a way to combat the effects of a gunshot wound is important. STB addresses the symptoms of gun violence. While fewer shootings may be expected, stakeholders should hope to see a reduction in the rate of deaths due to gunshot wounds. Again, per Strauss-Riggs et al., it is difficult to collect this information and parse any confounding variables that may contribute to the reduction, but it should be the goal.

B. ACTION FOR ST. LOUIS HEMORRHAGE-CONTROL TRAINING

As Jacobs, one of the developers of the STB program, states, "If somebody's bleeding, the public knows what to do, they feel empowered to do it, and there's a higher likelihood of survival."[246] Developing or adjusting a cost-effective hemorrhage-control training to be delivered in person to those most likely to be affected by gun violence may provide the skills necessary to improve survivability of a shooting dramatically, and subsequently, neighborhood dynamics and homicide rates. The evidence is certainly in

---

245 Goralnick et al., "Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS)," 797; Robert A. Katzer et al., "Implementing the Stop the Bleed Campaign in a University Community," *Journal of Education & Teaching in Emergency Medicine; Orange* 4, no. 1 (2019): 3–6, ProQuest; Pasley et al., "Stop the Bleed," 1638–39.

246 Mead, "Trauma Training Initiative Teaches Rural Laypeople How to 'Stop the Bleed.'"

favor of providing laypeople with the skills and equipment necessary to provide lifesaving care in the event of a shooting resulting in a major bleed.

Examples set by existing immediate responder programs are readily available and can be incorporated into any large-scale public access hemorrhage-control training. The B-Con curriculum already includes some of the things seen in other programs. For example, the first step in all the aforementioned programs—call 9-1-1 first—appears in B-Con. The biggest hurdle facing any large-scale public access hemorrhage-control training is access to the specialized equipment, like a tourniquet, necessary to save a person's life. The immediate responder must have a tourniquet to apply it. Finding materials and improvising a tourniquet can cost valuable time. Some jurisdictions, in preparation and acknowledgment of this requirement, have begun to stockpile bleeding control equipment in areas that may be susceptible to incidents that result in mass casualties.[247] Working to stock public buildings and spaces with trauma kits and individually issuing tourniquets, if not full trauma kits, to those completing public access hemorrhage-control training is absolutely paramount. However, public-access hemorrhage-control has to be accessible for vulnerable populations susceptible to violence. Realizing the full potential of public-access hemorrhage-control training cannot happen unless it is provided in the areas that need it most.

St. Louis and other major metropolitan areas can take steps to implement a hemorrhage-control training program in the hopes of saving lives and overcome the aforementioned hurdles. The following recommendations highlight a systematic and manageable approach to developing and delivering an effective program in St. Louis.

1. Identify Vulnerable Areas and Populations

Locating the areas most likely to benefit from hemorrhage-control training can help put the skills and the tools in the hands of those most in need. Using more detailed GIS analysis and merging of data sets can add to the picture of potential focus areas and the

247 Matthew J. Levy, "Intentional Mass Casualty Events: Implications for Prehospital Emergency Medical Services Systems," *Bulletin of the American College of Surgeons* 100, no. 1S (September 2015): 74; Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," 240.

institutions like churches, schools, and community centers that operate in those areas. Hemorrhage-control has to be accessible for vulnerable populations susceptible to violence.

2. Identify Potential Partners

Delivering training of any kind can be labor intensive. Hemorrhage-control training is even more so. Given that the training requires a lecture, a hands-on portion, and a requirement for a teacher-to-student ratio of 1:8, hemorrhage-control training resources and labor are demanding. Partnering with local hospitals and other medical professionals to help deliver in-person training is recommended. Similarly, partnering with first responders like police, fire, and EMS can add to the pool of potential instructors.[248]

Stakeholders should consider working with a media developer to find a way to provide portions of the training via video. The time and resources necessary to deliver a training in person is significant for both the trainers and the participants. Furthermore, being forced to deliver training solely in an in-person format limits the number of potential participants who can be reached in some capacity. As previously discussed, training via video, with respect to CPR, requires less time and fewer resources to deliver and complete.[249]

3. Systematically Collect More Data Specific to Homicides and Bodily Injury Location

While some systematically collected data are available that allow stakeholders to identify areas of high-gun violence, sufficient and readily available information on types of wounds and location on the body does not exist. Collecting and evaluating that data will provide a clearer picture of the potential impact a widespread hemorrhage-control training or focused tourniquet distribution can have. The first major step in widespread hemorrhage-

---

248 Partnering with neighborhood organizations, churches, schools, and other social groups in the most affected areas can provide opportunities to develop interest from the community and to provide trainings to willing and interested groups.

249 Allan Braslow et al., "CPR Training without an Instructor: Development and Evaluation of a Video Self-Instructional System for Effective Performance of Cardiopulmonary Resuscitation," *Resuscitation* 34, no. 3 (June 1997): 207, https://doi.org/10.1016/S0300-9572(97)01096-4.

control training or focused tourniquet distribution in St. Louis is to collect more data and make it readily available for potential stakeholders to evaluate.

Completing regular, systematic impact, and process evaluations could provide valuable insight on program strengths and weaknesses. Partnering with local universities and researchers well versed in evaluation methodology could be one opportunity to ensure consistent evaluation of the program. Once a program is developed and rolled out, it is imperative to keep in contact with those who have been trained. Collecting information regarding their use of the training and their retention of the information can be helpful in developing future training and equipment distribution plans. If they find certain aspects of training helped them more than others, adjusting future training may be warranted. While the basics of hemorrhage control training and tourniquet application are not necessarily new, developing effective, understandable, and user-friendly trainings is important.

4. Distribute Trauma Kits and Tourniquets

The biggest hurdle facing any large-scale public-access hemorrhage-control training is access to the specialized equipment, like tourniquets, necessary to save a person's life. To ensure timely application of tourniquets and other life-saving techniques, bystanders have to be equipped with the skills necessary to save lives in time-sensitive situations. As asserted by Tsui et al., predicting the locations where a tourniquet or trauma kit may be needed is difficult.[250] However, using the geography data provided for St. Louis and taking an approach similar to that of Narcan/Naloxone distribution could provide ample information to plan and focus recourses, training, and kits in the areas that would benefit the most.

The immediate responder must have a tourniquet to apply it. St. Louis should consider local legislation to require that buildings be outfitted with trauma kits and tourniquets, just as federal buildings have. Trauma kits should be readily available in buildings, but if they are not, providing those kits to individuals completing public access hemorrhage-control training is important. Perhaps putting up posters or directions for

250 Tsui et al., "Stop the Bleed," 1.

tourniquet application nearby or in those kits may be useful for those who have not been trained but have access to equipment during an emergency. A cost of such an effort must be considered, but as the cost of trauma kits continues to decrease, all participants in a given hemorrhage-control training may be given a kit after completing the course.[251] St. Louis should work to identify grant funding or allocate resources to help supply buildings and individuals in the most vulnerable areas of the city with trauma kits and tourniquets.

C. SUMMARIZING CONSIDERATIONS FOR ST. LOUIS HEMORRHAGE-CONTROL TRAINING

Hopefully, by building off the information provided in this chapter, stakeholders can build hemorrhage-control training programs that can reach the communities most likely to benefit. This chapter is meant to help illustrate the need for greater participation from citizens and distribution of trauma kits and tourniquets to those individuals who may use them. St. Louis faces a significant amount of violence, but the skills taught in a hemorrhage-control training can be used in any bleeding emergency. While violence is often concentrated in a few areas of the city, every person who lives and works in the City of St. Louis should have an interest in reducing violence. Helping to saves lives in the City of St. Louis benefits everyone; not just those directly impacted by violence.

251 Linda Carroll, "Homemade Kits with Tourniquets Make Gunshot First Aid More Available," Reuters, April 25, 2019, https://www.reuters.com/article/us-health-emergency-bleeding-idUSKCN1S12QK.

THIS PAGE INTENTIONALLY LEFT BLANK

V. RECOMMENDATIONS FOR NATIONAL HEMORRHAGE-CONTROL PROGRAMMING

While St. Louis provides a great starting point for discussion, traumatic injuries can happen at any time and any location.[252] A person can be shot and suffer a major bleed. A person can have from a severe hemorrhage due to a motorcycle accident. A life-threatening injury can occur in even the most benign of circumstances. In any case, when an injury results in a major bleed, it is often the result of quick thinking and makeshift tourniquets like belts, rubber bands, or hair ties that prevent substantial blood loss. In more serious cases, having immediate access to a tourniquet can mean the difference between life and death. For the skills learned in any hemorrhage-control training to be put to use, the immediate responder must have the necessary equipment and know how to use it properly. This conclusion includes broader recommendations for programs beyond those deployed in St. Louis and provides general guidance and recommendations for any jurisdiction, city, county, or state that may be creating programming to teach hemorrhage-control techniques to its citizens.

A. BROADEN ACCESS TO HEMORRHAGE-CONTROL TRAINING

Significant numbers of individuals can deliver STB training across the globe. The American College of Surgeons reports that more than 32,000 instructors are registered in nearly 80 countries, but the majority of those instructors, about 30,000, are in the United States.[253] At the end of 2018, only 403,000 people in the United States had training in STB, which is an extremely low number compared to the overall U.S. population.[254] Partnering with volunteer organizations and working to increase the number of trainers could provide additional means of instruction and increase the number of individuals trained across the country.

---

252 Personally, I think about a time in which I was on a ladder in my garage and lost my balance. I reached out to brace myself on the wall and ended up grabbing and dragging my hand across a bow saw. Similarly, I remember a neighbor slipping while mowing the lawn and severely cutting his foot.

253 Mead, "Trauma Training Initiative Teaches Rural Laypeople How to 'Stop the Bleed.'"

254 Mead.

Ensuring that vulnerable populations are provided such training and resources can offer them the tools they need to help save lives that may otherwise be lost. Research suggests that delivering training like CPR to those most likely to benefit from it provides the best use of resources.[255] To prevent disproportionate numbers of vulnerable populations from missing out on life-saving training, stakeholders should consider delivery options similar to CPR, including web-based or community-based training where applicable. Essentially, identifying those most likely to need and or use hemorrhage-control training is an important step in developing such a program. For example, CPR is taught to young children in scouts, lifeguards, medical professionals, and everyone in between. Moreover, the CPR program has allowed average everyday people with little or no medical training to step in and provide life-saving care when someone is in need.[256]

In an effort to expand the reach of hemorrhage-control training, stakeholders should consider pairing it with other immediate-responder training programs like CPR or AED. Some organizations—for example, the American Heart Association—provide training that teaches participants how to use AEDs along with CPR. Providing the hemorrhage-control training in tandem with CPR and AED material could magnify the impact by increasing the number of individuals exposed to the training. Similarly, combining all three could provide a solution to the issues regarding retraining and certification for hemorrhage-control instruction. However, a major concern involves the time and resources necessary to deliver such training, both for the trainers and the participants. Notably, training by video, with respect to CPR, requires less time and fewer resources to deliver and complete.[257] Furthermore, just as CPR instruction is deliverable via video, and given the advent of social media and video-sharing websites, substantial infrastructure is already in place to reach many people who have not had the opportunity to attend hemorrhage-control

255 Peter W. Groeneveld and Douglas K. Owens, "Cost-Effectiveness of Training Unselected Laypersons in Cardiopulmonary Resuscitation and Defibrillation," *The American Journal of Medicine* 118, no. 1 (January 1, 2005): 58–67, https://doi.org/10.1016/j.amjmed.2004.08.014.

256 Weidenauer et al., "The Impact of Cardiopulmonary Resuscitation (CPR) Manikin Chest Stiffness on Motivation," 2.

257 Braslow et al., "CPR Training without an Instructor," 207.

training in the past. At the very least, using online instruction to provide refresher tourniquet training could prove as useful and effective as it was for CPR.

B. ENSURE GREATER ACCESS TO TRAUMA KITS

Determining how to ensure that trauma kits are available to the individuals who need them is a significant conversation in the literature. Like AEDs, the purpose of locating trauma kits and tourniquets in publicly accessible locations, like on a wall or aboard public transportation, is meant to suggest providing supplies is more efficient than expecting people to frantically search for potential resources to make a tourniquet or a compression bandage. The goal is to provide adequate resources and tools to reduce the time to find or fashion a tourniquet or bandage and provide the specialized equipment to help ensure life-saving care is delivered effectively. In some instances, jurisdictions have elected to stockpile bleeding control equipment in areas that may be susceptible to incidents that result in mass casualties.[258] Some examples include movie theaters, concert halls, and sports arenas. Others suggest that co-locating trauma kits and tourniquets with AEDs is the most efficient way to ensure that resources are available when an emergency arises.[259] Should a jurisdiction choose either approach, evidence supports the need to supply tourniquets and gauze for 20–50 people, based on analyses of mass casualty events.[260]

The contents of a trauma kit can vary, but a standard minimum set of supplies must be made available. Figure 9 provides an example of a small trauma kit.

---

258 Levy, "Intentional Mass Casualty Events," 74; Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," 240.

259 Levy, "Public Access Bleeding Control," 235; Chambers et al., "'Stop the Bleed,'" 69.

260 Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," 237.

Figure 9. Bleeding Control Kit from B-Con Presentation.[261]

At a minimum, trauma kits require a tourniquet and gauze but may include trauma shears, wound dressings, and medical-grade gloves.[262] In some cases, trauma kits do include hemostatic gauze, but they require additional costs and maintenance due to expiration.[263] While standard trauma kits may not include hemostatic gauze, EMS should have such specialized equipment to ensure adequate response.[264] The kits should include multiples of necessary equipment like tourniquets. For example, Narcan comes in a two-pack in case more than one dose is needed. The drug can be administered more than once without concern of an overdose, so if a person does not respond to the first dose, an immediate

261 Source: American College of Surgeons, "Bleeding Control Basic (BCon) Course v. 1.0."

262 Chambers et al., "'Stop the Bleed,'" 69; Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," 236.

263 Chambers et al., 69.

264 Levy, "Intentional Mass Casualty Events," 74.

responder can administer a second. In a similar way, tourniquet applications sometimes take more than one to stop the bleeding. Stakeholders have to carefully consider the importance of supplying more than one tourniquet to individuals.

One area of serious concern should be how to deliver hemorrhage-control training to the public, not to mention deliver trauma kits to places that need them most. Homicides tend to cluster in urban cores and hotspots located in low-socioeconomic status areas.[265] Looking to past examples—for instance AED placement—does provide some possible insight into having trauma kits available when needed. Automated external defibrillators are a model of how to distribute tourniquets and pack gauze in case the need arises. Having trauma kits mounted on walls in buildings in a similar way or alongside AEDs can save time and resources by utilizing existing infrastructure. Regarding buildings, public transit, and other public spaces, placing trauma kits that include gauze and tourniquets alongside AEDs may be a viable solution.[266] However, locating trauma kits in buildings or on public transit does not address the issue of violence that may occur in residential neighborhoods and away from publicly accessible resources like AEDs housed in businesses or offices.

While providing public access to trauma kits is a step in the right direction, ensuring that individuals have access to personal trauma kits should be a goal moving forward. Naloxone provides a good example of an immediate responder program that requires having specialized equipment on hand. Stakeholders can look to the efforts made in Naloxone distribution as a way to distribute tourniquets or trauma kits to bystanders so they may carry them in bags or in their vehicles at all times. Similarly, working with neighborhood businesses to locate trauma kits in their buildings may serve as an option for further distribution. As the cost of trauma kits continues to decline, all participants in a given hemorrhage-control training can be given a kit after completing the course, depending on resources.[267] Contingent on the manufacturer, trauma kits can cost between

---

265 Steven F. Messner et al., "The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis," *Journal of Quantitative Criminology* 15, no. 4 (1999): 447.

266 Levy, "Public Access Bleeding Control," 235.

267 Carroll, "Homemade Kits with Tourniquets Make Gunshot First Aid More Available."

$50 and $75.[268] In some localities, trainers and doctors are building training and trauma kits for even less by finding ways to reduce labor costs.[269] As a result, realizing a goal of mass distribution of kits is nearly a reality.

C. INCREASE RETENTION AND PROVIDE RETRAINING OPPORTUNITIES

Having the opportunity to participate in hemorrhage-control training is valuable, but retaining and using those skills learned in a future emergency and being willing to intervene are the most important aspects. Increasing retention of the skills and information provided during the training is of the utmost importance to hopefully stop a bleed. The necessary instructions can be provided in several ways to ensure that those participants are able to act when called upon.

Increasing the availability of in-person training can be effective. The effectiveness of such training, in person or by some other means like flashcards or audio instructions, varies, but in-person training is regarded as the best method to ensure the retention of the information learned and the ability to apply the training three to nine months later.[270] Ensuring that hemorrhage-control training is taught face-to-face with an appropriate ratio of students to instructors is likely to produce the best retention of information.

Providing a certification program allows for a standardization of techniques and helps to ensure that those individuals receiving training are capable of demonstrating proficiency. At this time, no certification or required interval for retraining associated with the B-Con curriculum is in place. CPR requires that participants be recertified

---

268 Goolsby et al., "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty," 236.

269 Erin G. Andrade, Jane M. Hayes, and Laurie J. Punch, "Enhancement of Bleeding Control 1.0 to Reach Communities at High Risk for Urban Gun Violence: Acute Bleeding Control," *JAMA Surgery* 154, no. 6 (June 1, 2019): 550, https://doi.org/10.1001/jamasurg.2019.0414; Carroll, "Homemade Kits with Tourniquets Make Gunshot First Aid More Available."

270 Goralnick et al., "Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS)," 791.

approximately every two years to ensure they retain the knowledge and skills learned in training.[271]

Of concern is the fact that retraining or recertification is not expected currently, especially considering other immediate response programs. Research illustrates that CPR training is not retained well over long periods, so participants are required to recertify periodically by retaking the training.[272] Taking a page from CPR, it is reasonable to suggest that individuals who have completed hemorrhage-control training should complete refresher training in some fashion. As training expands and more research is completed in the future, hopefully a pragmatic and effective interval for refresher training can be identified. Again, at the very least, using online instruction to provide refresher training could prove as efficient and cost effective as it was for CPR.

At the very least, providing a simple nudge could help improve the efficacy of tourniquet application in emergency situations. Instructions on the side of a tourniquet may be helpful to jog a person's memory in a stressful situation. As illustrated with the AED and Narcan, providing clear, concise instructions on or verbalized by the equipment can help immediate responders properly deliver the life-saving interventions.

D. FINAL THOUGHTS

Gun violence is unfortunately a part of life in many U.S. cities, and given the seemingly never-ending discussion on how to identify, much less effectively manage, the causes of gun crime, providing a way to handle the immediate effects may save lives. Immediate responder programs like CPR, AED, and Narcan/Naloxone have provided generations of individuals with the ability to intervene in an emergency who are then responsible for countless lives being saved. Programs like STB have the same potential, and if they are properly developed, trained, and utilized, more unnecessary deaths can be avoided. Furthermore, while some might argue that STB is useful only in averting deaths from gun violence, the skills are applicable to any number of scenarios where a major bleed

---

271 American Heart Association, "Emergency Cardiovascular Care Course Card Reference Guide," 3.

272 Saramma et al., "Assessment of Long-Term Impact of Formal Certified Cardiopulmonary Resuscitation Training Program among Nurses," 231.

occurs. STB-type programming can help to change the outcome of innumerable shootings. In addition, the public and the communities that receive the training will have gained skills that they can use in almost any bleeding-related emergency. Expanding training like STB will, without question, prevent unnecessary deaths. It is my hope that the suggestions outlined in this thesis can provide the necessary pressure to help local governments and communities in St. Louis and across the nation to tighten up their efforts to support communities dealing with violence.

LIST OF REFERENCES

Ali, Safia Samee. "'They're Like Soldiers': Chicago's Children Are Learning to Save Lives amid the Gunfire." NBC News, July 17, 2019. https://www.nbcnews.com/news/us-news/they-re-soldiers-chicago-s-children-are-learning-save-lives-n1018196?fbclid=IwAR3PPlAcfgKaN96u9ChRxm36v4med6cHTtQ-mgD0IBmHWKtfLGWdjvTd88Y.

American College of Surgeons. "Bleeding Control Basic (BCon) Course v. 1.0: Instructor Information." 2017. https://www.stopthebleed.org/-/media/stop-the-bleed/instructor-files/bleeding-control-basic-instructor-guide.ashx.

———. *Bleeding Control (B-Con) Basic*. Chicago: American College of Surgeons, 2017. https://www.jaxsmp.com/wp-content/uploads/2017/02/Bleeding-Control-Basic-Instructor-Presentation-Notes-PPT.pdf.

American Heart Association. *2011 Basic Life Support (BLS) for Healthcare Providers Classroom Course & Materials Frequently Asked Questions (FAQs)*. Dallas, TX: American Heart Association, 2011. https://www.heart.org/idc/groups/heart-public/@wcm/@ecc/documents/downloadable/ucm_427486.pdf.

———. "AED Programs Q&A." 2018. https://cpr.heart.org/-/media/cpr-files/training-programs/aed-implementation/aed-programs-qa-ucm501519.pdf?la=en.

———. "Emergency Cardiovascular Care Course Card Reference Guide." November 2019. https://cpr.heart.org/-/media/cpr-files/resources/course-card-information/course-card-reference-guide-kj0916.pdf?la=en.

Andrade, Erin G., Jane M. Hayes, and Laurie J. Punch. "Enhancement of Bleeding Control 1.0 to Reach Communities at High Risk for Urban Gun Violence: Acute Bleeding Control." *JAMA Surgery* 154, no. 6 (June 1, 2019): 549–550. https://doi.org/10.1001/jamasurg.2019.0414.

Ashkenazi, Isaac, and Richard C. Hunt. "You're It—You've Got to Save Someone: Immediate Responders, Not Bystanders." *Frontiers in Public Health* 7 (December 5, 2019). https://doi.org/10.3389/fpubh.2019.00361.

Blackwell, Thomas H., and Jay S. Kaufman. "Response Time Effectiveness: Comparison of Response Time and Survival in an Urban Emergency Medical Services System." *Academic Emergency Medicine* 9, no. 4 (April 2002): 288–95. https://doi.org/10.1197/aemj.9.4.288.

Blewer, Audrey L., Said A. Ibrahim, Marion Leary, David Dutwin, Bryan McNally, Monique L. Anderson, Laurie J. Morrison et al. “Cardiopulmonary Resuscitation Training Disparities in the United States.” *Journal of the American Heart Association* 6, no. 5 (May 5, 2017). https://doi.org/10.1161/JAHA.117.006124.

Bommel, Marco van, Jan-Willem van Prooijen, Henk Elffers, and Paul A.M. Van Lange. “Be Aware to Care: Public Self-Awareness Leads to a Reversal of the Bystander Effect.” *Journal of Experimental Social Psychology* 48, no. 4 (July 2012): 926–30. https://doi.org/10.1016/j.jesp.2012.02.011.

Boy Scouts of America. *Boy Scout Handbook*. 1st ed. Irving, TX: Boy Scouts of America, 1911. https://www.gutenberg.org/files/29558/29558-h/29558-h.htm.

Braga, Anthony A., and Philip J. Cook. “The Association of Firearm Caliber with Likelihood of Death from Gunshot Injury in Criminal Assaults.” *JAMA Network Open* 1, no. 3 (2018): 1–10. https://doi.org/10.1001/jamanetworkopen.2018.0833.

Braga, Anthony A., Glenn L. Pierce, Jack McDevitt, Brenda J. Bond, and Shea Cronin. “The Strategic Prevention of Gun Violence among Gang-Involved Offenders.” *Justice Quarterly* 25, no. 1 (March 2008): 132–62. https://doi.org/10.1080/07418820801954613.

Braslow, Allan, Robert T Brennan, Mary M Newman, Nicholas G Bircher, Anne M Batcheller, and William Kaye. “CPR Training without an Instructor: Development and Evaluation of a Video Self-Instructional System for Effective Performance of Cardiopulmonary Resuscitation.” *Resuscitation* 34, no. 3 (June 1997): 207–20. https://doi.org/10.1016/S0300-9572(97)01096-4.

Butler, Frank K. “Military History of Increasing Survival: The U.S. Military Experience with Tourniquets and Hemostatic Dressings in the Afghanistan and Iraq Conflicts.” *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 60–65.

———. “Two Decades of Saving Lives on the Battlefield: Tactical Combat Casualty Care Turns 20.” *Military Medicine* 182, no. 3 (March 2017): e1563–68. https://doi.org/10.7205/MILMED-D-16-00214.

Butler, Frank K., and Richard Carmona. “Tactical Combat Casualty Care: From the Battlefields of Afghanistan and Iraq to the Streets of America.” *Tactical Edge*, Winter 2012.

Carroll, Linda. “Homemade Kits with Tourniquets Make Gunshot First Aid More Available.” Reuters, April 25, 2019. https://www.reuters.com/article/us-health-emergency-bleeding-idUSKCN1S12QK.

Chambers, James Alan, Kenneth Seastedt, Robert Krell, Edward Caterson, Matthew Levy, and Nancy Turner. "'Stop the Bleed': A U.S. Military Installation's Model for Implementation of a Rapid Hemorrhage Control Program." *Military Medicine* 184, no. 3–4 (2019): 67–71. https://doi.org/10.1093/milmed/usy185.

Darley, John M., and Bibb Latane. "Bystander Intervention in Emergencies: Diffusion of Responsibility." *Journal of Personality and Social Psychology* 8, no. 4, pt. 1 (1968): 377–83. https://doi.org/10.1037/h0025589.

Department of Health & Human Services. "Secretary Price Announces HHS Strategy for Fighting Opioid Crisis." April 19, 2017. https://www.hhs.gov/about/leadership/secretary/speeches/2017-speeches/secretary-price-announces-hhs-strategy-for-fighting-opioid-crisis/index.html.

Faul, Mark, Shelley N. Aikman, and Scott M. Sasser. "Bystander Intervention prior to the Arrival of Emergency Medical Services: Comparing Assistance across Types of Medical Emergencies." *Prehospital Emergency Care* 20, no. 3 (2016): 1–15. https://doi.org/10.3109/10903127.2015.1088605.

Fisher, Andrew D., Eileen M. Bulger, and Mark L. Gestring. "Stop the Bleeding: Educating the Public." *Journal of the American Medical Association* 320, no. 6 (2018): 589–590. https://doi.org/10.1001/jama.2018.7301.

Goolsby, Craig, Kandra Strauss-Riggs, Michael Rozenfeld, Nathan Charlton, Eric Goralnick, Kobi Peleg, Matthew J. Levy, Tim Davis, and Nicole Hurst. "Equipping Public Spaces to Facilitate Rapid Point-of-Injury Hemorrhage Control after Mass Casualty." *American Journal of Public Health* 109, no. 2 (February 2019): 236–241. https://doi.org/10.2105/AJPH.2018.304773.

Goralnick, Eric, Muhammad A. Chaudhary, Justin C. McCarty, Edward J. Caterson, Scott A. Goldberg, Juan P. Herrera-Escobar, Meghan McDonald, Stuart Lipsitz, and Adil H. Haider. "Effectiveness of Instructional Interventions for Hemorrhage Control Readiness for Laypersons in the Public Access and Tourniquet Training Study (PATTS)." *JAMA Surgery* 153, no. 9 (September 2018): 791–99. https://doi.org/10.1001/jamasurg.2018.1099.

Groeneveld, Peter W., and Douglas K. Owens. "Cost-Effectiveness of Training Unselected Laypersons in Cardiopulmonary Resuscitation and Defibrillation." *The American Journal of Medicine* 118, no. 1 (January 1, 2005): 58–67. https://doi.org/10.1016/j.amjmed.2004.08.014.

Gun Violence Archive. "Gun Violence Archive 2019 Evidence Based Research-since 2013." October 10, 2020. https://www.gunviolencearchive.org/past-tolls.

Harris, Taylor Tiamoyo. “Webster Groves Police Officer Shot along I-44, Suspect Dead.” STLtoday, May 6, 2020. https://www.stltoday.com/news/local/crime-and-courts/webster-groves-police-officer-shot-along-i-44-suspect-dead/article_0ef9b2e4-f68b-55b8-93ab-92d61ba43277.html.

Hawk, Alan James. “How Hemorrhage Control Became Common Sense.” *Journal of Trauma and Acute Care Surgery* 85 (July 2018): S13–17. https://doi.org/10.1097/TA.0000000000001862.

Holcomb, John B., Frank K. Butler, and Peter Rhee. “Hemorrhage Control Devices: Tourniquets and Hemostatic Dressings.” *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 66–71.

Hsu, Shou-Chien, Chan-Wei Kuo, Yi-Ming Weng, Chi-Chun Lin, and Jih-Chang Chen. “The Effectiveness of Teaching Chest Compression First in a Standardized Public Cardiopulmonary Resuscitation Training Program.” *Medicine* 98, no. 13 (March 2019): 1–5. https://doi.org/10.1097/MD.0000000000014418.

Jacobs, Lenworth M., Karyl J. Burns, Norman McSwain, and Wayne Carver. “Initial Management of Mass-casualty Incidents due to Firearms: Improving Survival,” *Bulletin American College of Surgeons* 98, no. 6 (June 2013): 28–31.

Kastre, Tammy. “Tactical EMS Saved Lives after Giffords Shooting.” *Journal of Emergency Medical Services* 37, no. 5 (2012). https://www.jems.com/2012/05/02/tactical-ems-saved-lives-after-giffords/.

Katzer, Robert A., David A. Beshai, Ajeet Pal Bayo Bhatia, and Andre Serop Ksajikian. “Implementing the Stop the Bleed Campaign in a University Community.” *Journal of Education & Teaching in Emergency Medicine; Orange* 4, no. 1 (2019): 1–16. ProQuest.

Kellermann, Arthur L., and Kobi Peleg. “Lessons from Boston.” *New England Journal of Medicine* 368, no. 21 (2013): 1956–57. https://doi.org/10.1056/NEJMp1305304.

Kierstead, Robert L. “Recommendation for a National Standard for Tactical Emergency Casualty Care and Israeli Hospital Trauma Protocols in the United States.” Master’s thesis, Naval Postgraduate School, 2015. http://hdl.handle.net/10945/45883.

Kilaru, Austin S., Marc Leffer, John Perkner, Kate Flanigan Sawyer, Chandra E. Jolley, Lindsay D. Nadkarni, Frances S. Shofer, and Raina M. Merchant. “Use of Automated External Defibrillators in U.S. Federal Buildings.” *Journal of Occupational and Environmental Medicine/American College of Occupational and Environmental Medicine* 56, no. 1 (January 2014): 1–14. https://doi.org/10.1097/JOM.0000000000000042.

Kim, Daniel, Kevin S. Irwin, and Kaveh Khoshnood. “Expanded Access to Naloxone: Options for Critical Response to the Epidemic of Opioid Overdose Mortality.” *American Journal of Public Health* 99, no. 3 (March 2009): 402–7. https://doi.org/10.2105/AJPH.2008.136937.

Korte, Charles. “Effects of Individual Responsibility and Group Communication on Help-Giving in an Emergency.” *Human Relations* 24, no. 2 (1971): 149–59.

Latané, Bibb, and John M. Darley. “Group Inhibition of Bystander Intervention in Emergencies.” *Journal of Personality and Social Psychology* 10, no. 3 (1968): 215–21. https://doi.org/10.1037/h0026570.

Lauritsen, Janet L., and Theodore S. Lentz. “National and Local Trends in Serious Violence, Firearm Victimization, and Homicide.” *Homicide Studies* 23, no. 3 (August 2019): 243–61. https://doi.org/10.1177/1088767919848665.

Lazar, Richard. “Reimagining CPR Training to Enable More Real-World Applications.” Occupational Health & Safety, February 1, 2020. https://ohsonline.com/articles/2020/02/01/reimagining-cpr-training-to-enable-more-realworld-applications.aspx.

Leeb, Frank A. “Saving the Savable: Using Bystanders to Increase Survival from out-of-Hospital Cardiac Arrest (OHCA) in New York City.” Master’s thesis, Naval Postgraduate School, 2016.

Lei, Roy, Michael D. Swartz, John A. Harvin, Bryan A. Cotton, John B. Holcomb, Charles E. Wade, and Sasha D. Adams. “Stop the Bleed Training Empowers Learners to Act to Prevent Unnecessary Hemorrhagic Death.” *American Journal of Surgery* 217, no. 2 (February 2019): 368–372. http://dx.doi.org/10.1016/j.amjsurg.2018.09.025.

Levy, Matthew J. “Intentional Mass Casualty Events: Implications for Prehospital Emergency Medical Services Systems.” *Bulletin of the American College of Surgeons* 100, no. 1S (September 2015): 72–74.

———. “Public Access Bleeding Control: Enhancing Local Resilience.” *Prehospital and Disaster Medicine* 31, no. 3 (June 2016): 235–36. http://dx.doi.org/10.1017/S1049023X16000467.

LifeSaving CPR Trainer. “How to Use an AED—Life Saving CPR Training Blog.” *Life Saving CPR* (blog). Accessed July 11, 2020. https://cprlifesaving.wordpress.com/2018/03/02/how-to-use-an-aed/.

Martin, Gary. “‘Standing on the Shoulders of Giants’—the Meaning and Origin of This Phrase.” Phrasefinder. Accessed September 12, 2020. https://www.phrases.org.uk/meanings/268025.html.

McCarty, Justin C., Zain G. Hashmi, Juan P. Herrera-Escobar, Elzerie de Jager, Muhammad Ali Chaudhary, Stuart R. Lipsitz, Molly Jarman, Edward J. Caterson, and Eric Goralnick. “Effectiveness of the American College of Surgeons Bleeding Control Basic Training among Laypeople Applying Different Tourniquet Types: A Randomized Clinical Trial.” *JAMA Surgery* 154, no. 10 (2019): e1–e7. https://doi.org/10.1001/jamasurg.2019.2275.

Mead, Allee. “Trauma Training Initiative Teaches Rural Laypeople How to ‘Stop the Bleed.’” *Rural Monitor* (blog). October 3, 2018. https://www.ruralhealthinfo.org/rural-monitor/stop-the-bleed/.

Messner, Steven F., Luc Anselin, Robert D. Baller, Darnell F. Hawkins, Glenn Deane, and Stewart E. Tolnay. “The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis.” *Journal of Quantitative Criminology* 15, no. 4 (1999): 423–450.

Office of Civil Defense. *In Time of Emergency: A Citizen’s Handbook on Nuclear Attack and Natural Disasters*. Washington, DC: Department of Defense, 1968. https://www.governmentattic.org/21docs/InTimeOfEmergency_1968.pdf.

Pasley, Amelia M., Brandon M. Parker, Matthew J. Levy, Anthony Christiani, Joseph Dubose, Megan L. Brenner, Thomas Scalea, and Jason D. Pasley. “Stop the Bleed: Does the Training Work One Month Out?.” *American Surgeon* 84, no. 10 (October 2018): 1635–38.

Philpot, Richard, Lasse Suonperä Liebst, Mark Levine, Wim Bernasco, and Marie Rosenkrantz Lindegaard. “Would I Be Helped? Cross-National CCTV Footage Shows That Intervention Is the Norm in Public Conflicts.” *American Psychologist* 75, no. 1 (2019): 1–10. https://doi.org/10.1037/amp0000469.

Pickvance, Chris. “The Four Varieties of Comparative Analysis: The Case of Environmental Regulation.” In C*onference on Small and Large-N Comparative Solutions*, 1–20. Brighton: University of Sussex, 2005. http://eprints.ncrm.ac.uk/57/1/chrispickvance.pdf.

Pivač, Sanela, Primož Gradišek, and Brigita Skela-Savič. “The Impact of Cardiopulmonary Resuscitation (CPR) Training on Schoolchildren and Their CPR Knowledge, Attitudes toward CPR, and Willingness to Help Others and to Perform CPR: Mixed Methods Research Design.” *BMC Public Health* 20, no. 915 (2020). https://doi.org/10.1186/s12889-020-09072-y.

Pons, Peter T., and Lenworth Jacobs. “What Everyone Should Know to Stop Bleeding after an Injury.” American College of Surgeons, 3, 2017. https://www.bleedingcontrol.org/-/media/bleedingcontrol/files/stop-the-bleed-booklet.ashx.

PrepMedic. “Stop the Bleed (Full Course).” May 26, 2019. YouTube. Video, 17:46. https://www.youtube.com/watch?v=WGLLXy3AsBQ.

Saramma, P. P., L. Suja Raj, P. K. Dash, and P. S. Sarma. “Assessment of Long-Term Impact of Formal Certified Cardiopulmonary Resuscitation Training Program among Nurses.” *Indian Journal of Critical Care Medicine* 20, no. 4 (April 2016): 226–32. https://doi.org/10.4103/0972-5229.180043.

Schwartz, Shalom H., and Geraldine T. Clausen. “Responsibility, Norms, and Helping in an Emergency.” *Journal of Personality and Social Psychology* 16, no. 2 (1970): 299–310. https://doi.org/10.1037/h0029842.

Smith, E. Reed, and John B. Delaney. “Supporting Paradigm Change in EMS’ Operational Medical Response to Active Shooter Events.” *Journal of Emergency Medical Services* 38, no. 12 (December 2013): 48–55.

St. Louis Metropolitan Police Department. *2020 UCR Homicide Analysis October 3, 2020*. St. Louis, MO: St. Louis Metropolitan Police Department. https://www.slmpd.org/images/Homicide_Stats_for_Website.pdf.

Starecheski, Laura. “Teaching Friends and Family How to Reverse a Drug Overdose.” NPR, December 29, 2014. https://www.npr.org/sections/health-shots/2014/12/29/371770229/teaching-friends-and-family-how-to-reverse-a-drug-overdose.

Strauss-Riggs, Kandra, Thomas D. Kirsch, Erik Prytz, Richard C. Hunt, Carl-Oscar Jonson, Jon Krohmer, Ira Nemeth, and Craig Goolsby. “Recommended Process Outcome Measures for Stop the Bleed Education Programs.” *AEM Education and Training*, April 16, 2020. https://doi.org/10.1002/aet2.10443.

Takooshian, Harold, Darren Bedrosian, John. J. Cecero, Lynn Chancer, Andrew Karmen, Jim Rasenberger, A. M. Rosenthal, Curtis Silwa, Charles E. Skoller, and Joyce Stephen. “Remembering Catherine ‘Kitty’ Genovese 40 Years Later: A Public Forum.” *Journal of Social Distress and the Homeless* 14, no. 1–2 (January 2005): 63–77. https://doi.org/10.1179/105307805807066284.

Tan, David, and Jeff Siegler. “Mo-Hope Project: Naloxone Antidote Administration for Suspected Opioid Overdose.” Mo-Hope Project, August 27, 2019.

Teixeira, Pedro G. R., Carlos V. R. Brown, Brent Emigh, Michael Long, Michael Foreman, Brian Eastridge, Stephen Gale et al. “Civilian Prehospital Tourniquet Use Is Associated with Improved Survival in Patients with Peripheral Vascular Injury.” *Journal of the American College of Surgeons* 226, no. 5 (May 1, 2018): 769–776.e1. https://doi.org/10.1016/j.jamcollsurg.2018.01.047.

Tsui, Michelle, Shannon L. Carroll, Daniel W. Dye, W. Andrew Smedley, Aidan D. Gilbert, Russell L. Griffin, Gerald McGwin, Shannon W. Stephens, Jeffrey D. Kerby, and Jan O. Jansen. “Stop the Bleed: Gap Analysis and Geographical Evaluation of Incident Locations.” *Trauma Surgery & Acute Care Open* 5, no. 1 (February 1, 2020): 1–4. https://doi.org/10.1136/tsaco-2019-000384.

U.S. Department of Health and Human Services. “What Is the U.S. Opioid Epidemic?.” December 4, 2017. https://www.hhs.gov/opioids/about-the-epidemic/index.html.

Watson, Matthew. “Equipping the Tactical Medic.” *Tactical Response*, June 2006.

Weichselbaum, Simone, Beth Schwartzapfel, and Tom Meagher. “When Warriors Put on the Badge.” Marshall Project, March 30, 2017. https://www.themarshallproject.org/2017/03/30/when-warriors-put-on-the-badge.

Weidenauer, David, Thomas Hamp, Christoph Schriefl, Caroline Holaubek, Markus Gattinger, Mario Krammel, and Markus Winnisch et al. “The Impact of Cardiopulmonary Resuscitation (CPR) Manikin Chest Stiffness on Motivation and CPR Performance Measures in Children Undergoing CPR Training—A Prospective, Randomized, Single-Blind, Controlled Trial.” *PLOS ONE* 13, no. 8 (August 16, 2018): 1–14. https://doi.org/10.1371/journal.pone.0202430.

Weiner, Janet, Sean M. Murphy, and Czarina Behrends. “Expanding Access to Naloxone: A Review of Distribution Strategies.” Penn LDI, Leonard Davis Institute of Health Economics, May 29, 2019. https://ldi.upenn.edu/brief/expanding-access-naloxone-review-distribution-strategies.

Welling, David R., Patricia L. McKay, Todd E. Rasmussen, and Norman M. Rich. “A Brief History of the Tourniquet.” *Journal of Vascular Surgery* 55, no. 1 (January 2012): 286–90. https://doi.org/10.1016/j.jvs.2011.10.085.

Woodson, Jonathan. “The Military Experience and Integration with the Civilian Sector.” *Bulletin of the American College of Surgeons* 100, no. S1 (September 2015): 22–23.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California